SCIENTIFIC AMERICAN

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May 27, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

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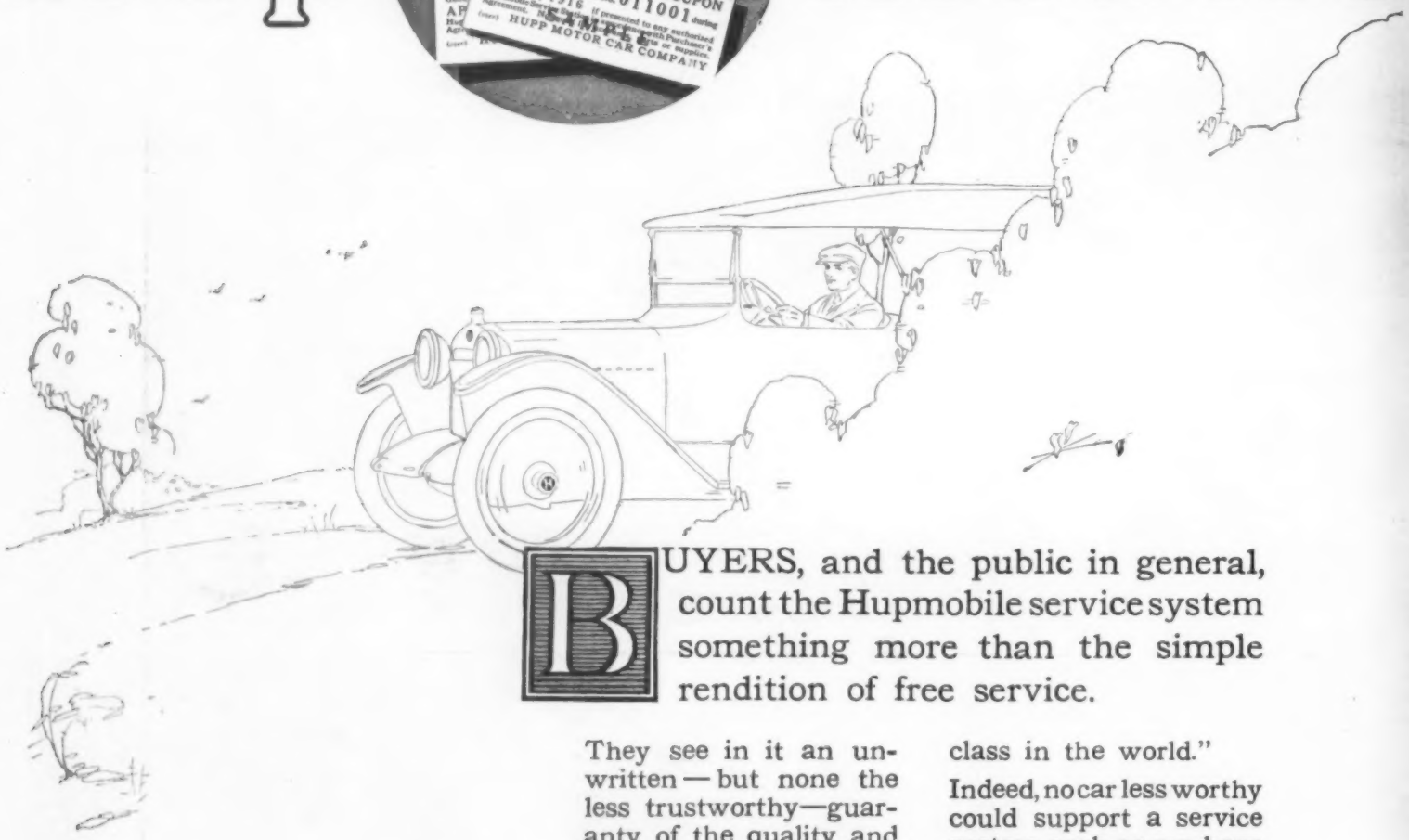

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SEVENTY-SECOND YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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A gentle shower, under perfect control. Showing installation of the overhead irrigating system on a New Jersey farm

Gathering lettuce on a 40-acre "patch." Four crops are matured and ready for market when best prices prevail

Turning Out Crops on Schedule Time

NATURE does not always do her own work best. At least, that has been the general experience of the farmer. Seasons are unhappily anything but uniform in the matter of weather, and a successful crop hinges very much upon the character and distribution of the sun's heat and the cloud's outpouring. Of the two, showers even more than sunshine are the prime concern.

This is all by way of prelude to describing just how one tiller of the soil has managed to circumvent these seasonal vagaries and to make it possible for farm products to be ripened on schedule time, and with a nicety of control that can best be likened to the output of a factory.

By means of a novel system of irrigation, Mr. Charles F. Seabrook, of Bridgeton, New Jersey, is able to raise products that are sold in Philadelphia and New York in direct competition with similar foodstuffs shipped from Florida at a time when the South has a decided climatic advantage. Further, he realizes a larger crop per unit of area.

The irrigation employed on his farm is of a sort that simulates a gentle rain and is delivered to the plants by a system of overhead pipes. These are perforated, and into each hole is screwed a wee brass nozzle that sends the water up into the air in the form of a fine spray. This settles upon the ground so that it does not hurt the texture of the soil, and is carried down to the thirsty roots with the least possible loss. A hard rain attacks the surface soil, packs it, and is very apt to leave water standing. This, when evaporated by the hot sun, causes the surface to crust, which prevents subsequent rain from working freely into the ground, and results in increased evaporation.

In a measure the same objection can be cited against irrigating by means of ditches and canals. A great percentage of the water is wasted; space is used that might otherwise be devoted to the raising of crops; far more water is necessary than the overhead system requires; and the seeds of weeds and the like are carried where they will cause trouble. Indeed, the very fertilizer is partly drawn away from the plants for which it is intended. Overhead irrigation is efficient and economical, because it is susceptible of the nicest control. It can be applied just when it will do the most good, and this may be at times only after nightfall.

About six years ago Mr. Seabrook equipped three acres of his farm with his rain-making apparatus. Last fall he had 110 acres so piped, and now this system of irrigation has been extended over 50 more acres of his farm. No matter how abundantly a soil may be fertilized, this enrichment will fail of its purpose without an ample supply of water carried down from the surface of the earth. It is in this way that the tonic of the fertilizer is dissolved and made ready for the roots to drink it in. This done, the moisture passes up through the plant and is in turn evaporated through the agency of the foliage. It is really a natural pumping system, and the function of the leaves is to complete the circulation. How necessary water is to plants can be gathered from the fact that for every ton of hay, let us say, 500 tons of water are required during the life history of the growing grass. Therefore, increased fertilization by stimulating plant growth incidentally augments the thirst. This very abundant foliage, in turn, enables the vegetable better to withstand nature's excess of rain. At the same time, a hardy plant quickly becomes too strong to be injuriously attacked by disease.

Digging potatoes. An early crop of 625 bushels to the acre, which brings a high price because of its priority

Bleaching celery by using paper instead of dirt. The ripening of the crop is thus successfully speeded up

How successfully this method of farming has worked out can be gathered from the following facts: In that part of Cumberland County the average farmer, employing customary methods, raises between 100 and 200 bushels of potatoes to an acre, while Mr. Seabrook obtains a crop of 625 bushels on the same unit of area. What is more than that, he gets his potatoes ready for the market some time ahead of his neighbors, and just when new potatoes bring high prices. Again, in that region the run of farmers are pleased if they get 3,000 baskets of strawberries per acre, while Mr. Seabrook isn't content if he gets less than 10,000 baskets of large, finely flavored fruit. And so it goes with all of his crops, which include, among other things, lettuce, romaine, celery, onions, carrots, radishes, beets, tomatoes, etc.

There is a period when young plants must be guarded against chill, and again a time when maturing plants must be protected from frost. For this service Mr. Seabrook uses what he calls "shade-cloth tents," a gauzelike fabric or special make of cheesecloth. This material acts like the wire netting around a miner's lamp and separates the two columns of air. As a result, the sun's rays can penetrate and heat the atmosphere beneath the tents and yet, after nightfall, that warmer air is held there by reason of the protecting meshes.

Farmers throughout the world might well follow Mr. Seabrook's scientific farming methods to advantage.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Report of the Conference Committee on the Army Bill

SENATOR CHAMBERLAIN, in presenting to the Senate the report of the conferees, announced that the final decision reached was the result of a compromise. He claimed that it was a good compromise, and, in so far as the Regular Army is concerned, his claim is justified.

The bill as now presented gives the organization asked for by the General Staff of the Army. It provides for seven regiments and two mounted battalions of Engineers, for sixty-five regiments of Infantry, twenty-five regiments of Cavalry, twenty-one regiments of Field Artillery, a Coast Artillery Corps of greatly increased size, and the necessary staff corps and departments for proper administration.

The Army as provided permits of organization into seven divisions of all arms, two cavalry divisions, and a slightly increased garrison for Alaska and Porto Rico. There will be assigned to the Philippines, the Hawaiian Islands and the Canal Zone, each one division, leaving four divisions and two cavalry divisions in the United States proper. The Coast Artillery Corps will be sufficient in strength to permit the manning of all coast forts in our foreign possessions and the manning of all mine fields and one half the gun and mortar batteries at home.

The organizations, however, are not at war strength. The infantry company is held to 100 enlisted men, while the drill regulations call for 150; the other arms of the mobile army are proportionately skeletonized. But even in this respect there is a considerable improvement, as the present infantry company has, until very recently, been limited to 65. And the bill leaves it in the discretion of the President to bring the units to full strength. Elsewhere in the bill, however, he is limited, except in time of actual or threatened hostilities, to a total force which will not permit full war strength of all organizations at once.

The Regular Army

There is a considerable difference of opinion as to the strength of the army authorized by the report. A reading of the bill accounts for this. The enlisted personnel of the Quartermaster Corps, the Ordnance Department and the Signal Corps are left to the discretion of the President, as is the organization of brigade, division, corps and army headquarters. Again, in Section 2, there is a proviso that the total enlisted force of the *line of the Regular Army, excluding the Philippine Scouts, the Quartermaster Corps, Medical Corps and Signal Corps, and the unassigned recruits*, shall not, except in time of actual or threatened hostilities, etc., exceed a total of 175,000 men. Since none of the branches italicized has ever been considered as part of the line of the Army, and since there are others not mentioned which also are not part of the line, an interpretation will be required to determine to just what troops the limit of 175,000 pertains.

Presuming that only those excepted are in addition to the force prescribed, the army would have between 210,000 and 215,000 enlisted men, depending somewhat upon the strength authorized by the President for the Quartermaster and Signal Corps; this on the assumption that all unassigned recruits authorized were on hand at depots. In addition to the enlisted men, the bill authorizes approximately 10,000 officers, combatant and staff, bringing the full strength to something like 225,000.

The increase is to take place in five yearly increments, the first becoming effective on July 1st, this year. This is a wise provision, as it enables the new material to be absorbed gradually. And the President is authorized, in emergency, to hasten the organization at his discretion.

What we are most interested in is the strength of the fighting army. As nearly as can be calculated (on account of some indeterminate units described) the following are authorized:

Normal Strength—

Engineers	Infantry	Cavalry	Field Art'y	Coast Art'y	Total
5,180	85,760	27,950	17,640	29,447	164,887

President may increase to—

7,874	126,065	39,820	27,384	29,447	220,590

The above is the enlisted force only; to these totals should be added approximately 7,000 officers for these branches.

It will be seen that the limitation placed on the total strength of the line of 175,000 will prevent the President from making the full increase in time of peace.

In addition to the new organization provided, there are many other praiseworthy features. Among these may be mentioned the enlistment clause, whereby a soldier need serve no more than one year with the colors if he qualifies for the reserve in that time. This, with other provisions favoring the formation of a reserve, should soon correct the absurd position in which we find ourselves to-day in this important factor of national defense. Also, it should serve to stimulate enlistments. The shortening of the required term of service to three years, greater consideration as to travel allowances on discharge, the opportunity for advancement offered by the extra non-commissioned positions for duty with the militia and at colleges should all serve to make the army a more attractive career for the class of young men we should like to have.

The aviation corps has been increased to more than five times its present size. There is a workable plan for a Reserve Officers Training Corps and the formation of an Officers Reserve Corps, and a liberal allowance of extra officers for duty with the National Guard and at colleges. In all, practically everything that could be asked for the Regular Army has been given.

The Federalized Militia

It is to be regretted that the same unqualified praise cannot be extended to the National Guard portions of the bill. Justice compels us to acknowledge that the conferees have done their best with an impossible situation. Every safeguard that could be thrown around the national interests appears to have been thought of. The very objectionable feature of detailing National Guardsmen on the General Staff of the Army has been dropped, and the requirements for a militia organization to become entitled to pay have been stiffened remarkably. The supervision of the Secretary of War is very broad and, if exercised as it should be, will easily prevent the expenditure of funds on those not returning service.

But, when all is said, the Militia remains the Militia and a state force. In spite of all the laws that may be written, the Constitution places limitations on its control and use by the President, which will govern just as soon as any individual or organization of that state force cares to appeal. If the Constitution did permit all that the proposed bill provides, and we could be sure that the bill would not be amended, there can be no doubt that the resulting force would be a better one than we have ever had organized in the states. The maximum instruction prescribed (48 drills per year and 15 days in camp) would cause a soldier of Europe who had gone through two years of intensive training seven or eight hours a day to smile; nevertheless, it will produce a better militia than any we have had to date.

The danger, of course, is that the bill will be amended. When the full 800 National Guardsmen have been enrolled in each Congressional District we may see the supervision of the War Department greatly reduced, and the restoration of all the porcine features now eliminated.

Better and wiser by far would it have been to have retained the Volunteer clause, and thus have enabled the President to organize a truly federal force, one over which his constitutional control would be unquestioned. This was strongly urged by all the Regular Army and was favored by the rank and file of the majority of the Militia. There seems reason for the statement of one Senator that "politics not preparedness governed the legislation in this respect."

As an exchange for the Volunteer Army, we have generous provision for camps of intensive training. All expenses of those volunteering to attend these camps are to be paid. This is a stop gap. These camps were originated by our leading military men *because there was no* dependable citizen army in reserve. They were the best that could be conceived without legislation authorizing such a reserve. But no matter what the success of these camps, *they cannot take the place of an organized force in being.* We can only hope that the influence of those attending will eventually bring about a reconsideration of the discarded provision for a federal force of trained citizens behind our Regular Army.

We now await the appropriation for munitions of war. Will Congress give the necessary funds for the additional arms, ammunition, equipment and other stores without which an army cannot be effective? Our lack in this respect has been broadly published. The people know the true conditions, and are watching hopefully for generous remedial action. To vote for more men and make no provision for arms and equipment would be futile legislation; for the outstanding lesson of the European war is the controlling importance of guns, shells, machine guns and rifles.

Build the Ships To-day

WE commend to the "small navy" members of Congress, whoever they may be, the story of the decline in relative strength of the United States Navy, which is illustrated in the comparison to be found on another page of this issue.

It was about a decade ago that the dreadnought era opened, and up to that time the United States was recognized as the second great naval power in the world. At that time our fleet was markedly superior to that of Germany, the third ranking power; for the twenty-four ships of our pre-dreadnought fleet were not only on the average larger, faster and better protected than those of Germany, but their gun power was overwhelmingly greater, the total energy of all guns of the battleships being about 3,800,000 foot-tons, as against a total gun energy for the twenty German battleships of 1,640,000 foot-tons.

So effectively have the "little navy" men in Congress carried on their senseless war against naval preparedness that to-day we have lost our second position to Germany and are in danger of being outstripped by France. The conditions in comparison with Germany have been completely reversed, so that, judged on a basis of first-line battleships (dreadnoughts and battle-cruisers), we have less than half as many ships completed, namely, twelve as against twenty-six, and the total gun energy of our first fighting line is but 7,417,736 foot-tons against the total of 13,226,000 tons, representing the total gun energy of the German dreadnought fleet.

That is what the spirit which has been back of the so-called pacifist movement has done for the United States Navy; and we invite the attention of the exponents of that movement, both inside of Congress and out, to the fact that our present diplomatic relations with that power which has moved into the second position which we have so fatuously given up, is such that at any hour a little indiscretion or deliberate bullheadedness on the part of a submarine commander may find us at war with that naval power which to-day is so vastly stronger than we are ourselves.

Surely it is a truth which goes without saying, that if we are to have a navy, it should measure up to the full limit of its responsibilities. The navy which we have is absolutely first-class, both as to ships, officers and men; but it is altogether too small for the enormous task of safeguarding the lives, homes and property of a country which numbers 100,000,000 people and whose wealth is double that of any other nation.

It is one of the first, if not the first, of the duties of Congress to bring up our Navy with the greatest possible speed to the position which it once held, and has now lost. Secretary Daniels's five-year program will never accomplish this. Battleships, battle-cruisers, scouts and destroyers should be built up to the full limit, year by year, of our shipbuilding facilities. We are gratified to note that President Wilson is reported to be in favor of building four battle-cruisers and two dreanoughts this year.

The House Committee on Naval Affairs has voted for five 35-knot battle-cruisers, four 35-knot scout cruisers, ten destroyers, twenty submarines, one hospital ship, one fuel ship, and one ammunition ship. This program does not meet the emergency. It should be increased by two battleships, twenty destroyers, and four scout cruisers. We should have four destroyers to each battleship in our Navy, and the proposed battle-cruisers call on this basis for twenty destroyers.

Americans to Aid Reconstruction in France

THE American Manufacturers Export Association of New York, a national body including several hundred of the largest manufacturing exporters in the United States, is now organizing an American industrial commission to visit France during June and July next, with the full approval and cooperation of the French government, for the purpose of making an exhaustive and technical investigation of present conditions in that republic, looking to the reconstruction and reorganization of her communities and industries.

Already plans are being evolved in France, not only for rebuilding those of her factories which have been destroyed by the war, but for equipping with the most modern machinery her existing industries, and putting these in a condition to increase their output and to enable the Republic to meet on equal terms the tremendous commercial competition which is expected to follow the close of the war.

Automobile Notes

Low Grade Fuels Coming.—At a meeting of the Society of Automobile Engineers a speaker recently said: "We are going to be face to face with the necessity of burning low grade fuels; and if we simply postpone it we are just putting off the trouble. The garage man, if nobody else, is going to make us face the problem, because he is putting kerosene into the gasoline."

Difficulties in Shipments.—Owing to the difficulties in procuring suitable freight cars for shipping automobiles, many companies have been using flat cars, covering the shipment with tarpaulins; but it is found that many of the detachable fittings, such as speedometers, spare wheels, rims, tires and tools disappear en route. Now the wise ones are stripping the cars of everything readily removable, and shipping these parts separately.

Cost of Running the Car.—"In spite of the high price of gasoline, it really does not cost us any more per mile to run the average 1916 car than it did the cars of 1905 or 1906," is the statement recently made at a meeting of the Society of Automobile Engineers, and the speaker further said: "The increased efficiency of engines and decreased weight of car have certainly enabled us to go more miles on a gallon of gasoline; in fact, I think almost double what was possible ten years ago, or even five years ago in this country."

Armored Fighting Cars.—A year ago great things were expected of the armored automobile, and it certainly made a good record for a while; but as soon as both armies dug themselves in its usefulness was greatly discounted. Where armies are engaged in active and rapid movements, not mere sorties from trenches, the armored car is of great value, but at present it is being little used in France. On the other hand, the ammunition and supply cars that have to go up to the front are now frequently armored, with advantage, although their means of offense, or rather defense, is limited to the rifles of their guards.

Developing Aircraft Engines.—Some of the most successful aircraft motors now used abroad were developed, tested and worked out by mounting them in a racing type automobile chassis which enabled long and severe trials to be made under constant observation. This method is now being adopted by one of the prominent American automobile companies, which is building a very successful twelve-cylinder automobile engine, and now, with a view to preparedness, is at work on developing designs for aircraft service. It is proposed to thoroughly compare engines with four, six, eight and twelve cylinders of equal piston displacement, and undoubtedly the data obtained will be of great value in developing new designs. Such efforts are not only evidence of commercial progressiveness, but are distinctly patriotic, for as the war goes on we more fully appreciate the backward condition of our aeroplane service.

Other Types of Engines Should Be Developed.—The following significant statement was recently made in a discussion before the Society of Automobile Engineers: "There is another fact that we as engineers should not overlook: Other types of engines than those built on the Otto cycle may and should be developed for use in automobiles. An engine built, for example, on some constant-pressure cycle will not only give a higher thermal efficiency, but possesses certain inherent qualities, notably a more nearly constant torque, that make it more like the steam engine. Engines built on the Otto cycle have a theoretical maximum thermal efficiency of about 35 per cent. In practice the best that can be obtained is 18 or possibly 20 per cent. This is only under maximum-load conditions. But on the average automobile engines run at very low duty and with low compression pressures. Under those conditions the thermal efficiency may be as low as two or three per cent." Who will be enterprising enough to start the movement?

High Gears on Hills.—Are not automobile manufacturers and dealers injuring themselves by putting so much stress on the hill-climbing qualities of their cars on high gear? The amateur driver is told that his car can climb anything on high, and naturally he attempts to do it, with the result that he seriously racks his car by hanging onto the high gear too long, and then takes a week's wear out of the gears in attempting a frantic, last second change. It is exceedingly poor policy, and bad practice as well to hang onto the high gear on a hill until the engine begins to pound, in the hope of pulling up the last few yards without a change, as this pounding indicates that the engine is being strained in a way that will surely shorten the period of its usefulness. The gear should be invariably lowered while the engine is still pulling freely, and further lowered at the slightest sign of distress. The loss in time resulting from this system of driving can be counted in seconds, while the increased usefulness of the car is measured by months.

Science

Amundsen's North Polar Drift.—Captain Amundsen's project of exploring the north polar regions by drifting with the ice, after the example set some years ago by Nansen in the "Fram," was temporarily abandoned at the outbreak of the European war, but has now been revived. The explorer hopes to set sail next summer.

Gregorian Calendar in Bulgaria.—According to the London *Times*, the Bulgarian national assembly has voted to adopt the Gregorian calendar in place of the Julian or eastern calendar, to which it has hitherto clung chiefly in deference to the Russian hierarchy. This desirable reform is, therefore, partly due to political motives.

Meteorology for Military Aeronauts.—Under the auspices of the British Meteorological Office a professorship of meteorology has been established for the purpose of giving instruction and conducting researches in that science in the interests of the Royal Flying Corps of the British Army. The incumbent of this post is Mr. G. I. Taylor, late Shuster reader in meteorology at the University of Cambridge, who receives the temporary rank of major in virtue of his new duties.

Foreign Marine Charts.—The U. S. Hydrographic Office announces that it has made substantial progress in the important work of reproducing by the photolithographic process, on zinc plates, the British Admiralty and other foreign nautical charts that it has heretofore been obliged to purchase from abroad, and it is expected that our navy and merchant marine will soon be independent of foreign chart makers. During the past year the office purchased 19,222 charts from the British Admiralty.

Fertility of Pollen Affected by Transfusion of Sap.—The following interesting experiment is reported by R. Holmes in the *Gardeners' Chronicle:* A large plantation of a certain variety of fruit trees failed to fruit. It was found that they could be made to fruit freely when artificially pollinated with pollen of another variety. In order to effect the same result, a graft of the pollinating variety was inserted on the top of each tree. In due time, following this procedure, the trees fruited, but the grafts had not borne any flowers, and consequently had not produced any pollen! Apparently the character of producing fertile pollen had been introduced merely by the transfusion of sap from a fertile to a sterile variety. Further experiments are being conducted in this connection.

Education Benefits the Farmer.—A circular recently issued by the Missouri Agricultural Experiment Station records the results of a comparison made in 1912 between two groups of farmers; viz., 554 who had received only a rural-school education and 102 who had received a greater amount of education, extending, on an average, through two years of high school. From this comparison it appears that the better educated farmer is making an income 71.4 per cent greater than the farmer with less education, and even after the labor income of the latter is adjusted to allow for his smaller size of business, the difference still amounts to about 40 per cent. Not to mention the intellectual benefits of an education—far surpassing anything that can be measured in terms of dollars and cents!

Discovery of the Remains of Another Eoanthropus.—Sir Ray Lankester in his "Diversions of a Naturalist," published last fall, makes what is perhaps a premature announcement that Mr. Charles Dawson has made a recent discovery of a second skull of the same character as the first. He goes on to state that this discovery was made *at the same spot* (Piltdown), and remarks that this justifies a certain amount of hesitation in concluding that the lower-jaw and the first found skull belong to one individual (*Eoanthropus*). On inquiry we find that this second series of bones, although found in gravel of the same age as that of Piltdown, is from a bed situated one or two miles away from Piltdown. There is evidence that the lower-jaw of this second individual was of the same type as that found associated with the Piltdown skull.

Do Bees Injure Fruit?—An agricultural society of Florence, Italy, has recently carried out a thorough investigation of the alleged injury of fruit by bees, and has completely exonerated the latter. Bees are unable to perforate the skin of fruit, and it is only incidentally that they suck the juices of fruits injured by other natural causes. The damage sometimes attributed to these insects is due to poultry, wild birds, wind and hail, and even more frequently to hornets, wasps, vine-moths, and other insects. Instead of being harmful to orchards and vineyards, bees perform the useful service of effecting the cross-pollination of flowers and hence the setting of fruit, as well as the desiccation of damaged fruits (especially grapes) by sucking the juice and pulp and thus preventing fermentation and rot extending to sound individuals. The orchards and vineyards frequented by bees give the most constant crops.

Invention Notes

Invented the Rotary Cement Kiln.—The death was announced at East Orange, early in March, of Dr. George Duryee, the inventor of the rotary cement kiln. He practiced medicine for forty years in Albany, N. Y., and about twenty years ago he became interested in some cement enterprises, and, realizing that the cement industry was hampered by the lack of proper manufacturing facilities, he gave up his practice and made the rotary kiln, which was soon resorted to generally. The improvement was responsible for a great change in the business. He was also responsible for several improvements of a minor nature.

Ready Made Tees for the Golfer.—The ready-made tee is one of the latest refinements of golf. The device has been recently patented. A board designed to be sunk into the ground of the "green" has a depression in it made to accommodate a revolving device with a variety of "seats" disposed upon its surface, any of these being presented according to the desire of the player. Three of these seats, it is anticipated, will be sufficient to gratify the whim of any golfer, although more may be mounted upon the spindle if it should prove desirable. This will save the time and temper of players in making the tee from the sand and water which form part of the equipment of the teeing ground.

Water Leak Detector.—To the proprietor of a large industrial establishment where the water supply is drawn through a meter, the matter of leakage is a very important one, for a comparatively small number of leaks working constantly as they do, may be responsible for a considerable increase in the bill at the end of the year. A means of detecting and locating these leaks has been devised. The appearance of the instrument used is much like the receiver of a standard telephone set. The point of the instrument is placed in contact with an iron rod driven in the ground or to the key which has been placed in position on a street surface valve, and if there is any leak in the vicinity, it is betrayed by sounds in the instrument.

New Features in a Locomotive.—Samuel M. Vauclain, of Philadelphia, whose name has long been associated with the designing and building of locomotives, was recently granted a patent covering certain improvements in compound locomotives of the centipede type, in which there are three pairs of cylinders. In this instance there are three independent frames connected by articulated joints; two cylinders are mounted on each frame, one at each side of the locomotive. There are preferably eight driving wheels for each set and the cylinders are coupled so that one high pressure cylinder will exhaust into two low pressure cylinders at one end of the locomotive and the other high pressure cylinders will exhaust into the low pressure cylinders at the opposite end of the locomotive. By this arrangement it is possible to make all the cylinders of the same size, thus materially economizing in the cost of the manufacture of a locomotive.

Turnstile to Prevent Crowding the Mine Cages.—Ten men is the limit of the safe capacity of the mine cages at the mines of Jermyn & Co. at Rendham, but when the workmen are eager to get to or away from their work they will not pay attention to this restriction, and the result is that accidents are likely to result. This carelessness or negligence on the part of the workmen has been overcome by an ingenious invention of the superintendent, John Corcoran. It consists of a turnstile with four spaces, which will revolve exactly two and a half when it reaches the limit of the screw on which it is mounted. Then the gate to that shaft is closed and that to the adjoining shaft opened, and ten men admitted by the turnstile revolving in the opposite direction to that shaft. The only way in which more than ten men can get by this turnstile at one time is by climbing over it, which is rendered somewhat difficult by the construction of the turnstile.

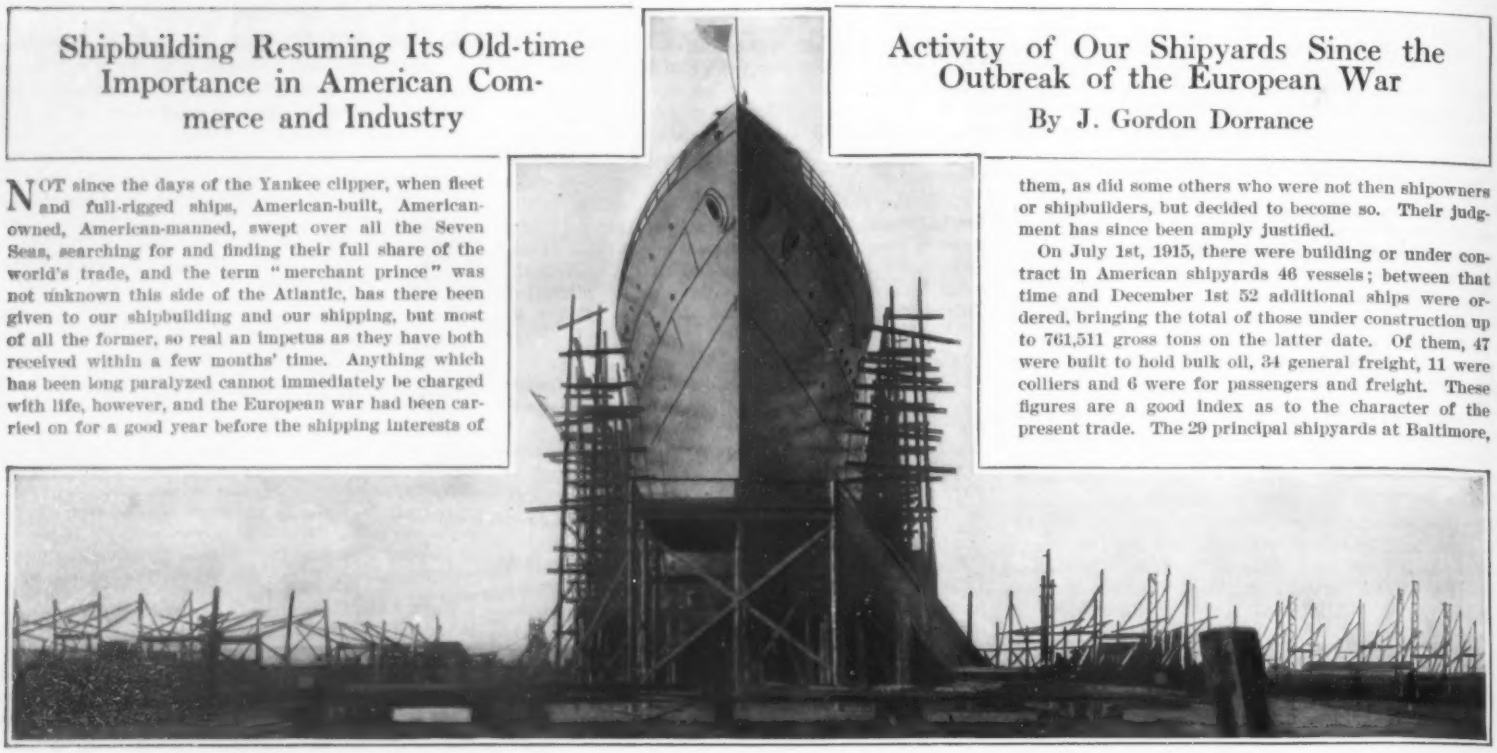
Electricity as a Tree Pest Cure.—Patent papers were recently granted to Isadore Kitsee, a Philadelphia inventor, covering a process for the destruction of insect and germ life harmful to plants and trees, the electrical method taking the place, to a great extent, of the usual sprays and other applications. The process consists of making an application of a solution such as saline water where the ground is to be treated, and then causing a current of electricity to be passed through the soil, whereupon the gas generated will rid the soil of germs, larvae and insects without the least injury to the vegetation. Where a larger area is to be treated, it has been found desirable to dig shallow trenches at opposite sides of the area to be treated, and the electric terminals are placed in these. An application of a somewhat more powerful current will rid the entire area of pests. When the plant itself is to be treated, the solution carrying the element is made the electrolyte in an apparatus, and the plant sprayed with a solution after decomposition has taken place through the action of the electric current.

Shipbuilding Resuming Its Old-time Importance in American Commerce and Industry

Activity of Our Shipyards Since the Outbreak of the European War

By J. Gordon Dorrance

NOT since the days of the Yankee clipper, when fleet and full-rigged ships, American-built, American-owned, American-manned, swept over all the Seven Seas, searching for and finding their full share of the world's trade, and the term "merchant prince" was not unknown this side of the Atlantic, has there been given to our shipbuilding and our shipping, but most of all the former, so real an impetus as they have both received within a few months' time. Anything which has been long paralyzed cannot immediately be charged with life, however, and the European war had been carried on for a good year before the shipping interests of America began to feel in earnest an improvement in the different branches of their trade. Almost until the late summer of last year they were doing, it is true, a good business in repairing many foreign, and a few domestic, ships, but yards were operating at less than normal, with business by no means unusually good. Just then, however, things began with a rush, and it is probably safe to say that there is not now one plant in the United States, equipped for modern work, which does not have its docks, as well as books, quite comfortably full of a new sort of business.



Ready for launching. The hull is finished, and the S. S. "Ulysses" is shown on the ways, waiting to take the plunge

Credited in 1909 with 1,353 ship and boat building plants, 40,506 wage earners, and a combined product worth annually $73,361,315, it then held but thirty-fourth place among the great American manufacturing industries in labor employed, standing just sixtieth in the value of its products. Not a very good rating, you will say, for a land like ours, with its thousands of miles of coast, its dozens of harbors offering easy approach and adequate berths, and its quite unexcelled facilities and water-ways of every sort. Yet this is by far the better side of the account, for the wage earners given employment then had decreased 13.4 per cent from 1899, 20.2 per cent from 1904; with respective declines in products of 1.6 and 11.4 per cent for the same periods.

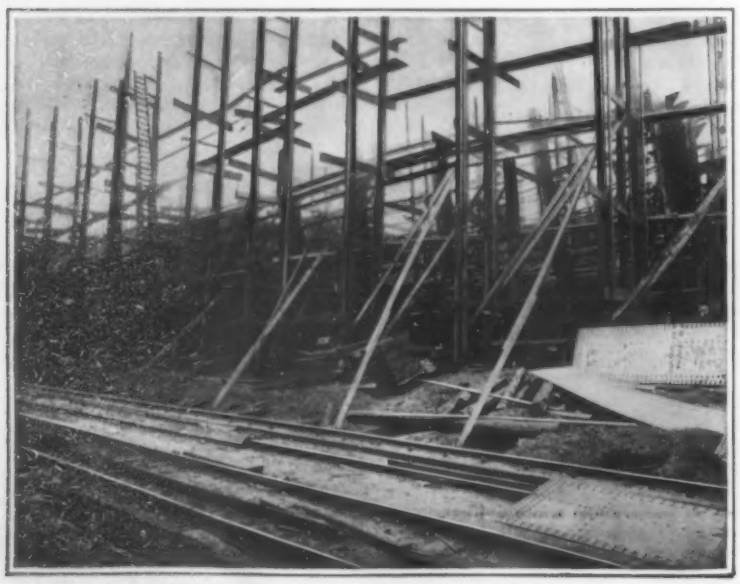
In 1800 this country, then very new, was constructing at a few yards scattered along the Atlantic seaboard vessels amounting to 106,261 gross tons. Fifty years later this had risen to 279,255, a healthy increase, surely, considering the times and the existing opportunities, but during the next half-century, to 1900, it had grown to only 393,790 tons. The latter period was also one of transition from vessels all of wood to those built principally of steel and iron; it should have been a constructive stage. But the small growth shown was in reality little more than a decline, and this decline was not long in manifesting itself in other ways. Exports of domestic merchandise for fourteen years, from 1901 to 1914, averaged in value $1,774,000,000 per annum. Those worth $1,570,000,000 were sent in ships, the rest in cars, and American steamships carried 7.3 per cent of the American exports, foreign vessels of course the rest. In 1901 the rating was only 4.8 per cent; in 1906, 9.2 per cent; and in 1914 it was but 7.8 per cent. Things nautical had reached their low ebb here, and it was then that chance, abetted somewhat by the old Yankee readiness to seize an opportunity, interfered to make a change.

Some of Europe's great home industries were slowing down, their mines among the rest, and with a dwindling output came, in most cases, a heavily increased demand. France and England were ready to take all of the American coal that they could get. Price was not the great consideration, either. It was ships. Italy and Spain, to a lesser extent Russia, were similarly disposed toward American fuel, metal and foodstuffs, and while these countries were attempting to buy here, some others, like Japan, were beginning to direct attention there, and wisely starting to build ships. Perhaps we might have missed this opportunity, as we seem to have overlooked some others along Transatlantic and Pacific commerce lines in recent years, but vessels of foreign make were beginning to have their registry changed under the Act of August 18th, 1914, so that some few American shippers began to see their chances, and took them, as did some others who were not then shipowners or shipbuilders, but decided to become so. Their judgment has since been amply justified.

On July 1st, 1915, there were building or under contract in American shipyards 46 vessels; between that time and December 1st 52 additional ships were ordered, bringing the total of those under construction up to 761,511 gross tons on the latter date. Of them, 47 were built to hold bulk oil, 34 general freight, 11 were colliers and 6 were for passengers and freight. These figures are a good index as to the character of the present trade. The 29 principal shipyards at Baltimore, Newport News, New York, Philadelphia, Wilmington, San Francisco and other centers were, as they are now, full of both men and boats, and working over-time. Earlier in the summer these people complained of having to employ 200 men where there was room for 500, and how many of them have twice the latter figure working on domestic orders which must be filled to clear the ways for more. Yards have been doubled in size and capacity, and new ones put in use.

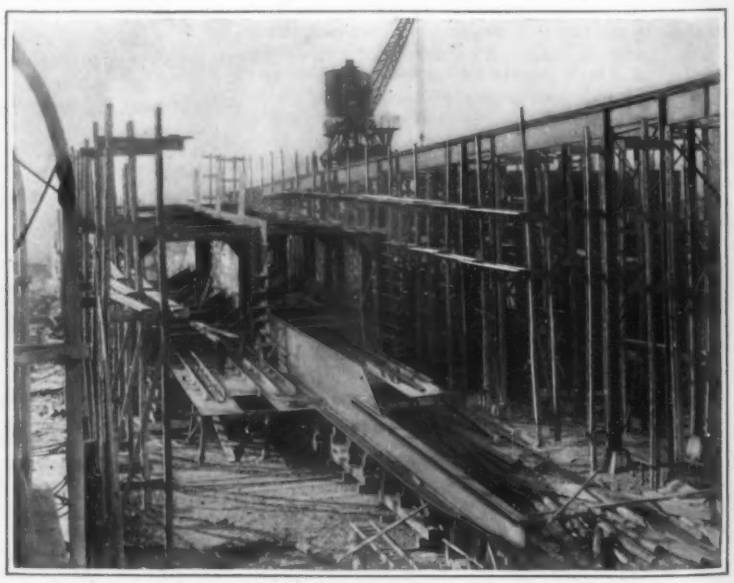
Deducting vessels lost, abandoned or sold to aliens up to December 1st, there is a net increase of 187 vessels, 53,829 gross tons, in our Merchant Marine since the 1st of last July, a better showing, certainly, than we have seen for some time past. There is now under construction at just four of the leading yards a gross tonnage amounting to 413,000, as contrasted with a total of 316,000 tons for ships built during the year of 1914, and 346,000 for those of 1913. Vessels arriving last year at the port of New York were 10,279 in number, and 9,203 for the year before. German and Austrian vessels declined 397 in that time, some others also, so that the comparison drawn is even more encouraging.

This sudden momentum is not confined to any single part of the country. Some of the smaller cities—Bath, Maine; Manitowoc, Wisconsin; Ferryburg, Michigan; and others—are looking forward, so reports have it, to shipping and shipbuilding booms. The House Merchant Marine and Fisheries Committee is asking for additional steamship inspectors, and in New York city plans have been laid for the largest sectional floating dry dock in the United States. Prices of American-built vessels



The first step

Inside the dock the steel ribs of the framework are appearing, and the new boat, a freighter, is just beginning to take shape.



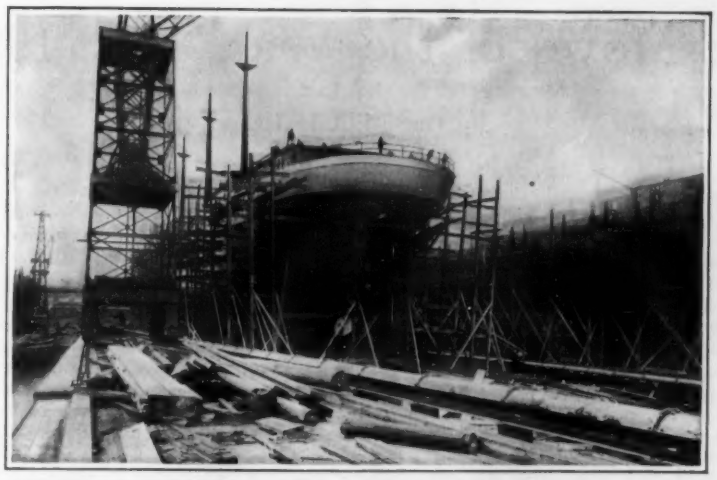
A busy corner

Shifts of men are doing double duty, and each ship in building is rushed to completion to make way for the next.

have advanced 50 per cent in six months; labor has enjoyed a corresponding increase. Some of the greatest shipbuilding nations in the world, formerly, are now no longer able to hold their own along commercial building lines. Other countries are stepping into their places—Norway, Denmark, Sweden, these latter both building at home and buying here. But yet the world production of ships is very far below the normal, and manufacturers here are trying hard to make this up.

A man prominent in shipbuilding said not long since that his business, and that of practically all others, was no longer a question of costs and prices, but of deliveries. "If we can get the steel, our plants will operate twenty hours a day for more than a year on orders already placed; and it is all *building*. Practically no repair work is being handled now, for under present industrial and economic conditions there is relatively no profit in it. Ships being built for the Transatlantic trade are ranging in price from $500,000 to $1,250,000, and most of them are paying for themselves within a year." Owners cannot afford the delays repairs entail, nor builders afford to make them with their prices for gross tons rising from $60 to $95 in much less than one year. So that the present loss from neglected and postponed repairs and overworked ships is adding to their usual depreciation, only contributing to the enormous demand for other and newer ones.

Of course the export trade is showing enormous increase also. It is a one-sided development, however, for shippers claim they cannot afford to develop a trade with South America, no matter how profitable it might be ordinarily, while present freight rates across the ocean and the European markets hold. Washington once said that "instead of relaxing, we ought to improve the present moment as the most favorable to our wishes." American shippers and ship-makers *are* improving this present moment, and just now one has a trade which is only gaged by the ships at hand to carry it, the other rapidly-growing business the extent of which seems only measured by the capacity of all the yards in use. We must look to a well-sustained continuance of these conditions after the "boom" has passed.

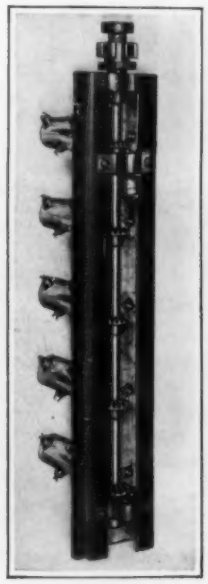


In the American shipyard all is now activity, and new docks are going up where before there was often not work for the old

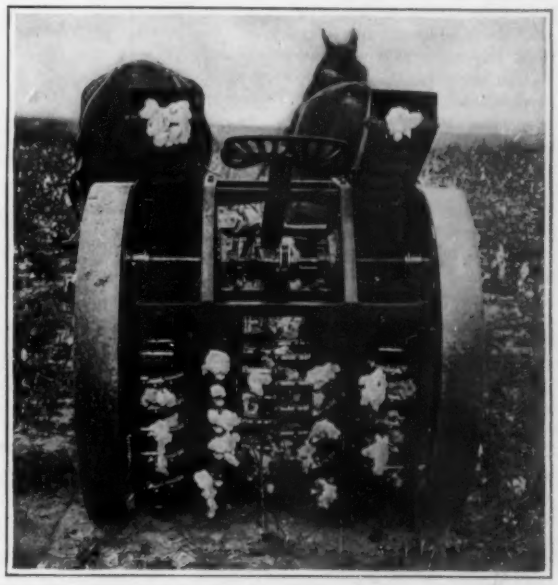
The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2108, for May 27, will be found an interesting article on *The Turquoise*, which gives curious information, relating to its supposed medical qualities, and the superstitions of many lands. There are several illustrations. *Diving and Diving Apparatus* gives something of the history of these devices by means of which men can work in the depths of the sea, and facts connected with their use, together with an illustration. *Military Telescopes and Binoculars* describes a variety of optical instruments that are used for making observations during military maneuvers, and a number of illustrations and diagrams accompany the text. The lectures by Sir J. J. Thomson on *Radiations from Atoms and Electrons* are continued. A timely article is that on *War Projectiles*, which gives details in regard to the calibers of the various shells now being used by different countries. This is an extremely valuable article for the technical reader. *Surface Combustion* is a subject that has not, as yet, been given the attention it deserves. The survey of the subject here given, together with facts and diagrams, is of more than ordinary interest. *Steam Power for Aeroplanes* sounds like a step backwards, but this article gives the results of a serious technical study of the subject by a steam specialist, and it demonstrates that in following the gasoline fashion sight has been lost of the modern advances that have been made in developing steam power, and the wide possibilities of application these have made. The facts here given will be a revelation to many. *The Buoyancy of Zeppelins* discusses the function of the ballonet, and how the buoyancy of these craft of the air is adjusted to varying aerial conditions. Other articles of value in this issue include *Babylonian Cosmology; Metals to Replace the Carbon Arc* and *Platinum, Varnish Troubles*, besides various technical notes.

Cotton-picking machine, showing the arms which carry the rotary picker points for plucking the cotton bolls



Rear view of one of the slats



Rear view of the cotton-picking machine, showing how the seed is plucked by the picker points and delivered to the hopper

A Machine That Picks Cotton Without Injuring the Plant

WITH the cost of labor constantly rising, particularly during the past twelve months, many American industries are confronted with a serious problem. And the problem is the more serious in those industries where human labor still reigns supreme and where machinery has made but slight, if any, inroads. A typical instance is the cotton-growing industry, in which the picking of the bolls is still done by hand.

During the year 1914 the cotton produced in the United States aggregated 16,645,272 bales, representing the crop yielded by 36,960,000 acres of land. This quantity represented about two thirds of all the cotton marketed in the world. The cost of picking has been mounting steadily in the cotton growing states and some time ago it attained an average of 75 cents for 100 pounds of seed cotton, with prices ranging from 60 cents to $1 and higher, according to the season and section in which the cotton was being gathered. It is safe to assume that the prices have again climbed to higher levels, following the trend of increasing wages in all other industries.

From the foregoing it becomes apparent that the cotton grower's problem is serious indeed, not only because of the high cost but also because of the loss incurred from rain and storms during the season from the want of help at the right time. It has long been realized that suitable machinery should contribute much toward solving the crop-gathering problem of the cotton grower, and many cotton-picking machines have been invented. In the majority of instances, however, these machines have proved unable to displace manual labor for a variety of reasons. A fairly successful type of machine has been developed, in which two finger-like members serve to pluck the cotton bolls by becoming wrapped up in them, but trouble is often experienced by the fingers becoming twisted together or out of shape.

The latest attempt to replace the human element in cotton-picking is in the form of a horse-drawn machine of simple yet promising design. It is mounted upon two large wheels with the mechanism for gathering the cotton placed between them. In operation the machine is drawn by two horses directly over a row of cotton plants, so that the picking members can pluck the seed cotton and deposit it in a large wooden hopper carried at the rear of the vehicle.

The cotton-picking mechanism of the machine resolves itself into 100 fixed arms, each carrying a number of revolving picker points. The arms are fastened upon substantial metal slats, while a rotary motion is imparted to the picker points by a suitable arrangement of gears. The slats move backward at the forward speed of the machine, the motion being supplied by power from the wheels, transmitted by a chain drive. The picker points and their slats are arranged in two groups, as may be seen in the accompanying illustrations, with a space in the center between which comes the cotton plant to be plucked. As the machine moves forward over a row of plants, the arms carrying the picker points gather the fluffy bolls from practically every part of each plant. The arms remain stationary with the plant while the entire machine moves forward, so that there is no danger of injuring the plant which may still have a further crop to yield in the immediate future. The action of the mechanism is to close in on a cotton plant, pluck off all the matured seed cotton, and then release the plant at the rear of the machine. The picker arms then pass around to either side of the machine, still retaining the cotton. Here the direction of rotation of the picker points is automatically reversed, with the result that the seed cotton is released and falls to a conveyor below. The latter carries the cotton up to the hopper or bin at the rear of the machine, completing the cycle of operation. The freed picker points then are carried around to the front

(*Concluded on page* 564)

Strategic Moves of the War, May 19th, 1916

By Our Military Expert

THE attention of the general public has been invited to the failure of the German offensive at Verdun more than to any other phase of the great European War at the present time. Either analytically or instictively, purely mechanical failure has not been expected of the German arms; their combinations, execution and comprehension of military expediency have been hitherto so scientifically accurate and impeccable that some material measure of victory, if only moral, has been generally anticipated. It is with no note of regret that the Kaiser has missed his target, with no eulogy of allied accomplishment that these lines are written; the cold fact remains that the great effort upon which Germany had relied, upon which she had calculated the gain to be made by an anticipated sacrifice of men for the gaining of a, to her cause, worth while object, has not brought about the results she hoped for, counted upon.

There is a reason for all this. And in the last analysis it is to be found in the steppes of Russia, in the incalculable resources of man-power potential within the limits of the great white empire. In justifiable apprehension of the power of the Czar's strength, should it ever be developed to its full extent, Germany knew that her favorable decision, should it be reached, must come before Russia and her allies could adequately gird their unprepared loins for the test.

It has been a game of give and take, with Germany superior in organization and ready-at-hand force, against an adversary of double her strength if it could be aroused from a deadly lethargy before too late. Germany has gained territory upon the west, and paid for it in blood; territory upon the east, at the same though relatively lesser price; territory to the southeast at even less vital cost. The numerically strong yet weakly armed hosts of Russia have been locally vanquished, made to concede thousands of square miles of homeland territory before tactics, strategy and system. France has witnessed the almost complete occupation of Belgium by her enemy and the wresting from herself of valuable lands, including the most productive iron regions of her domains. Serbia is now nothing but a dependency of the Hohenzollerns. If peace should come to-day, Germany would have won her desired place in the sun and hold all the trumps in the game of barter and bargain which is known as the diplomacy of a war's conclusion.

But peace is not at hand; so the answer cannot now be said to favor Germany, for the struggle must be continued further in the war of attrition which the Entente is evidently waging.

France has held the greater extent of her territory free of her invader; her battle lines have stopped every assault at every point since the inauguration of the deadlocked trench warfare; and the courage and determination of France to fight to the bitter end, whatever it may be, has been strengthened and amplified by the moral victory accrued to her at that militarily unimportant point, Verdun.

The theme of this article is the salvation of Russia, as the salvation of the Entente cause seems to lie with the same nation. Without France, Russia would probably fall; without Russia as a constant menace, France, even with the tardy aid of England, would long since have been brought to taw, policed as Serbia and Belgium have been policed, with control of continental affairs in the hands of Germany despite England's dominance of the sea. It boils down to arithmetic; no country or minor confederation of countries can dominate the world of the great Powers.

The history of the Verdun campaign is full of things significant, but with none more so than the fact that with all her daring and efforts, Germany has never been unwise enough to strip her front which confronts the English, who, in the hour of France's need, took over mile after mile of trench sector previously occupied by Joffre's men; for a great army which has been raised under Kitchener, under the handicap of somnolence and political interference, has been held in leash for just some such opportunity.

The domination of Serbia has permitted Germany to withdraw numerous divisions from that conquered land. The industrial poverty of Russia, with her three distinct defeats and the favor of the season have permitted the Kaiser to call to the western lines army corps with safety. And his efforts have been met, checked, stripped of gain.

Germany has by no means given up. There is an arithmetical limit to the number of men who can be placed upon a given extent of line, and Germany (the Central Empires) still has ample to man them. But the weight of reserves for a gigantic enterprise are lacking, just as France, if she were alone, would lack them.

The safety of Russia therefore lies with France, or, rather, with the situation upon the battle line in France to-day. While it is entirely possible that Germany may launch a great offensive upon the Russian front within a reasonably short time, it cannot again embrace the entire extent of the position, for with the Entente forces on the west ready to seize any presented opportunity for attack, as exemplified by the French assumption of the offensive with the attempted withdrawal of the German forces before Verdun a few weeks ago, Germany cannot dare strip her western line of men for the purpose.

Relation of the eastern and western battle-fronts

Russia is vastly better off in numbers and general preparedness than she was a year ago; but she is by no means in perfect condition for war. Her political organization is too much handicapped by looseness and pork-grabbing to match the centralization of German strength which has become so apparent with each passing month of war. It is entirely probable that if Germany should throw even a fair measure of her remaining strength upon the lines of the Czar, they would be compelled to give way, Riga be taken, even the Mohilev Railway, of superlative importance to Russia's communications behind her battle line. But Germany cannot now dare to turn her back upon her foes of the west, for they are in too greatly preponderant strength.

Germany can count upon little from Turkey. The armies of the Grand Duke threaten the safety of the entire land. Bulgaria will not unguard her own doors—for there are 600,000 allied troops almost at her borders, at Saloniki, and her territorial integrity is at stake. England has over 1,000,000 men on the western line—with two millions in Albion or on the way to continental positions; France has approximately three million men, all waiting for a favorable opportunity, a weakening of the lines before them, to strike for a decision.

Weighing the factors pro and con, it appears as though Russia will not again be called upon to bear the full brunt of the Kaiser's offensive. Locally, yes; but no mighty combinations of army corps being shuttled across the empire in forty-eight hours from front to front. The distance is now too prohibitive, when a determined assault may smash through things in a few hours that have taken months and years to build.

In the earlier days of the war one heard often of the slow grinding of the Russian "steam roller." The magnitude of her vast man-power appealed to a public not yet used to armies counting up into the millions, and it could not be grasped that with such a horde available sheer weight of numbers would not count immediately. Vaguely, the public supposed that Germany was perfectly prepared for war, France a little less so, England still in her might, with Russia somewhere nearby in the scale of technical preparedness, and it was not until the second monumental defeat of the whole Russian army was registered to the credit of Germany that realization came of the horrible political hodge-podge which existed within the Czar's broad country. Undoubted stories of graft in high places, of needed munitions held back for commercial purposes, and inefficiency on the part of those entrusted with the defense of the state came to hand, and it was generally understood that Russia, at the beginning of the war, was but the hulk of a nation, like a giant without coördination of brain and brawn. If the plans of Germany as to the prompt and decisive defeat of France had not miscarried, resulting in the necessity for engaging in trench siege warfare from the Channel to Switzerland instead of merely occupying the territory, Russia would have crumpled and the war would have been over months ago, with Germany everywhere victorious and with every victory consolidated.

But France was not defeated, for she held Germany at the battle of the Marne and thereby spilled the beans. The full strength of Germany could never thereafter be directed against Russia, the menace to the Fatherland on the east; and with the passing of each month while the Entente found themselves, after such a reverse as Verdun, in particular, opportunity fled further, until to-day it seems beyond recall.

From the Russian standpoint, then, France and her stand, not forgetting that of the King of the Belgians, saved Russia in the beginning, and the demonstration of line-holding at Verdun with the evidence of tiptoe readiness to take advantage of any opportunity for offensive action points very clearly to the fact that France to-day stands as Russia's safeguard, for Germany dares not turn her back.

A Significant Automobile Record

AUTOMOBILE records are without number, and most of these are mainly of value for advertising purposes; but a performance that has just been announced seems to establish facts of general interest to the public in relation to the much discussed question of the dependability of the multi-cylinder engine. Although engines having over six cylinders, which appears to be the accepted line of demarcation between the so-called "simple" and the multi-cylinder machine, have been in use for some time, an impression still exists that the apparent complication of an engine having more than six cylinders is liable to affect its reliability under hard, continuous work, and this is the point that the present test appears to meet and answer in a very practical way.

The test in question was a record run from coast to coast by an eight cylinder car made by one of the first companies to place this type of car on the market. The start was made from Los Angeles at 12:01 A.M. on May 8th, and ended in New York at 2:43 P.M. on the 15th, an elapsed time of 7 days, 11 hours and 42 minutes, allowing for the difference in standard time between the two places, the distance being estimated at 3,380 miles. This makes the daily mileage average about 450 miles. For comparison it may be stated that the previous one-man automobile record, which,

(*Concluded on page 564*)

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Opportunities for South American Trade

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest in your issue of April 1st a letter on export trade from a man who very evidently knows the subject. For years I have asked school principals at home why Spanish is not a compulsory study in all schools, and the answer invariably was that they would prefer to see French taught, being the language of politeness. Now it may be very polite to be able to read a French menu and know which is the fish and which is the roast, but there is no money in it. For years our export journals have been thundering "Preparedness" at American manufacturers, and yet I have known hundreds of these manufacturers who, when approached by the advertising representatives of these journals, would ask, "What is the smallest space I can take?" This oft repeated question exactly typifies the attitude of manufacturers toward export trade. They feel they ought to do something, but they do not want to spend much on it.

My last trip through Spanish America and Brazil has lasted two continuous years, and I have seen so many examples of wasted energy and wasted money that it would be laughable were it not pathetic. Starting at the top, I have met representatives of the Department of Commerce who had to go about with interpreters, because they could not speak the language. I have seen much advertised investigators come down on special missions and stay just a few days attending banquets and making and receiving addresses, then returning to Washington and publishing a lengthy report which, of my own knowledge, was inexact. I could give you dozens of instances of representatives of American firms rushing from one city to another, always in feverish haste, and always lamenting because the Latin will not buy the first day you call on him. Do not let us cry over the sinful waste of money; that is as nothing compared to the *opportunity* we are wasting. When this war is over we will find that the Germans, the English and the French will swoop down on Latin America with methods so far superior to ours that the little we have gained will be swept away in a month.

What the American manufacturer needs to-day—at once— is a central selling organization which will handle the output of several hundred manufacturers at the least cost to each one, but just as scientifically for each. To begin with, each and every clerk and salesman in this selling agency must be Spanish or Spanish American, of proved business ability and selling experience, and the manager must himself be the most perfect example of a Spanish American business man procurable. With the capital back of such an organization it would be possible to establish branch houses of this agency in every commercial center of Latin America, all working in scientific unison toward the common end. If ever such a selling agency is started and managed as I have said, I predict a real conquest of Latin export trade, provided—and mind this proviso—that part of the duties of the staff shall be to keep ears and eyes open for every possible opportunity for obtaining concessions and investments for American capital for railways, mines, and other business enterprises. This must form an important duty of the agency. Every South American traveler will tell you that the railways of Argentine, capitalized in England, prefer to buy of English makers. The few French railways give preference to French goods, and the hundreds of German capitalized companies want to see the "Made in Germany" stamp on all they buy. Let us, therefore, show our capitalists how to invest in Latin America, and breed in them the same loyalty for American made goods. Then we shall have secured, almost automatically, outlets for our goods hitherto undreamed.

I have read that a so-called export expert has said that the day of long credits has passed, never to return. It will return the day after peace articles are signed ending the European war. In this connection we have need for American capital to establish banks of discount at all the important commercial centers in these countries. I do not mean the "branches" of a well known American bank. These are well enough in a way, but they have not really helped export business. What we need is an immense central bank, with branches in each city, which will guarantee credits. Then an American house can grant the long time credits that are usual here, but only after this credit has been approved by the local branch bank. Once such approval is given, the American house presents proofs of delivery, receives cash payment at once from the bank, less a commission, and the bank takes charge of collecting the bill when due.

A few years after such a central bank has been in working order it would be possible for that institution to present to these southern republics a plan whereby that central bank shall issue all the currency to be used by all the republics, thus insuring a fixed rate of exchange for all and a remarkable falling off in revolutions. It is the power to keep a printing press working overtime turning out bank bills which makes the revolutionist willing to risk his life to get at that printing press.

Caracas, Venezuela. E. C. DE VILLAVERDE.

A River of Mud

To the Editor of the SCIENTIFIC AMERICAN:

It was my pleasure to be one of a party which made a trip into what is known as "The Smoky River Region," northern Alberta, Canada, during the fall of 1915. The Smoky River has its source on the north side of Mt. Robson, thence flowing north into the Peace River. Little of the country tributary to it has been mapped, and but few portions even explored by the white man. However, judging from the well worn trails, drying racks, and tepee poles, the Indian lived and hunted this section in days gone by.

While traveling down the most southerly branch at the head of Rock Creek (which heads against the Sulphur, a tributary of the Smoky) we crossed a most unusual stream, one so different from the common conception of a stream as to be of some scientific interest. Briefly, we came upon a "River of Mud."

Accepting the evidence obtainable on one visit, this river is composed, year in and year out, of a mass of mud. With its origin on the mountainside, it is presumably fed by the spring slides, kept moist by the summer rainfall, and frozen solid in winter. It may thus be likened to an ordinary water stream, many of which likewise have spring and summer periods and which cease flowing during the winter freeze. In its movement it is more like a glacier in that its motion is so slow as to be imperceptible. That it does move is not to be questioned, as its path through the thick timber is very marked, and along its edge are to be seen some of the trees it has cut down and carried along. Unlike a glacier, there is no terminal moraine. A glacier, at its foot, melts and flows away, leaving an accumulation of rocks, but any heavy masses that may be in this river of mud must settle to the bottom and remain concealed by the mud itself.

This mud river debouches on a flat, spreading out fan-like, and indeed the entire flat at the forks of Rock Creek gives evidence of having been formed from this and similar rivers. The flat is well covered with muskeg, with many islands which were quite likely formed by mud waves such as were observed, for example, when the Hunts Point (Bronx, N. Y.) fill was being made recently.

We were sorry not to have time in the examination of this curious river, but the primary object of our trip was big game rather than scientific knowledge. I did, however, make a sextant reading, computing the approximate location as 53-29′ N. lat., 118-35′ W. long.

Upper Montclair, N. J. C. S. RINDSFOOS.

The Sugar Beet and the Gasoline Situation

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 29th there was printed an article on Denatured Alcohol as a Substitute for Gasoline by Stanley Pike. I wish, with your permission, to make a few comments on this article, not in the way of criticism, but to supplement it slightly.

I have been very much interested in this question of a substitute for gasoline and have believed for a long time that alcohol was the best thing in sight. Even aside from the use of alcohol in motors there are so many ways in which it may be utilized in cooking, in lighting, etc., which are well known abroad, but which have not been developed here, that a demand is sure to be created in the near future.

In Mr. Pike's article the statement is made that the sugar beet will probably never be used as a source of alcohol because the American farmer will not go to the trouble of cultivating it. Here I wish to disagree a bit. Let me explain. It seems to be one thing to cultivate beets for sugar and quite another to grow them for alcohol. The sugar beet is a forced product, some four generations of intensive culture being necessary to produce the seed. Beets grown under the best circumstances will have a sugar content of 12 per cent, or even more, but when neglected the sugar content runs down very rapidly. The beets for sugar are planted thickly, then thinned out when they come up, the weeds being removed by cultivation, then when the beets are larger, weeds must be removed by pulling them out by hand. This is back breaking work and the farmer either hires it done, which much reduces his profit, or else does the weeding himself, which lessens his enthusiasm for that kind of a crop. Now if beets are given less intensive culture the sugar content will run down, to be sure, but sugar is not necessary for making alcohol. Starch will make alcohol just as well and even cellulose will do and both of these are present in the low grade beet. To make alcohol from the low grade beet requires a slightly different method of procedure. The beets are cooked under pressure with a slight amount of sulfuric acid, a method well known to the potato alcohol makers, and the starch and to some extent the cellulose will be hydrolyzed to form glucose which on fermentation gives us a larger amount of alcohol than could be obtained from the juice of the high grade beet. It seems also that if the industry were developed the cultivation of a low grade beet would be even easier than the cultivation of potatoes.

I agree with Mr. Pike that there is no better way to bottle up energy than to take it from the sun's rays, and I think these rays can be caught very profitably by the leaves of the low grade sugar beet. If Mr. Ford is looking for a cheap motor fuel, why not try a few experiments with alcohol grown from sugar beets right there in the home of the sugar beet?

Hamilton, N. Y. R. B. SMITH.

"Strays" in Wireless Telegraphy

To the Editor of the SCIENTIFIC AMERICAN:

I noticed in a recent issue of your paper two articles which I have read with interest; one is on the subject of "strays" in wireless work, and the other on an experiment where a shingle was used on a phonograph as a reproducer.

I have experimented with a wireless and many other instruments concerning the so-called "strays." I noticed that it was mentioned in that article that these strays had been noticed simultaneously at two stations, a long distance apart. I have found these "strays" stronger in the summer and on stormy nights than any other time. I have many times, during a heavy snow storm, drawn a steady spark or stream of sparks from my aerial. At other times, when the air was very clear and cold (about zero), and I could not hear "static" to any extent ordinarily, I could "tune to" the station at Key West and hear much "static." I could do this with many of the stations in the South, even though they were not working, merely by "tuning to" their wave-length. I concluded that "static" storms were in progress at these points and that in some manner I was enabled to hear these by "tuning to" their waves, "reflected" from the aerials.

As to the phonograph experiment, I have performed many interesting ones with a phonograph record, but one of the most interesting is that of changing the sound vibrations directly to electrical waves. Take an ordinary telephone transmitter and solder a phonograph needle to the outer shell, perpendicular to the tangent of its edge. Connect the transmitter up to a pair of receivers in the ordinary manner, using three cells (dry) in series with the transmitter and primary of an induction coil. Connect the 'phones to the secondary. Let the needle rest lightly on the record while running at ordinary speed, and the music will be heard in the receivers as loud as common, and much clearer, no "diaphragm and horn" sound being heard. These can, of course, be amplified with an audion or other amplifier, and reproduced at a distance with a "loud talker."

Milroy, Ind. HUBERT MCILVAINE.

The Federalization of the National Guard

To the Editor of the SCIENTIFIC AMERICAN:

One of the arguments thrown at the undecided and semi-informed general public, by the enemies of reasonable preparedness was editorially quoted in the SCIENTIFIC AMERICAN of recent date, *i. e.*, the federalization of the National Guard a menace to the country.

Before seeing the statement in your columns, that the federalizing of that body was one of the greatest dangers that this country now faces, the writer had supposed the idea merely one of the links in the chain with which the "Too proud to Fight" people hope to fasten the Dove of Peace to the American Eagle.

The injustice done the members of the organized militia, by even the thought of the possible gigantic political machine, is incalculable, and certainly does not but add to the number of barriers in the rough path over which they must needs travel.

The National Guard is composed of men, who—in place of ambling along proclaiming to all who will listen, that "one citizen of the United States could down at least three of any other nation or group of nations"—does his bit of studying and drilling, realizing, as his noisier fellow (citizen?) does not, that there must be an end to everything, even notes of protest.

So they actually believe that a man with gumption enough to stand the gibes of these pests would lower his personal standard, or that of his organization, to become the tool of a politician!

What's past is done, what the future holds none can discern, but why not help nail the Stars and Stripes to the mast instead of sawing at the halyards?

R. M. D.

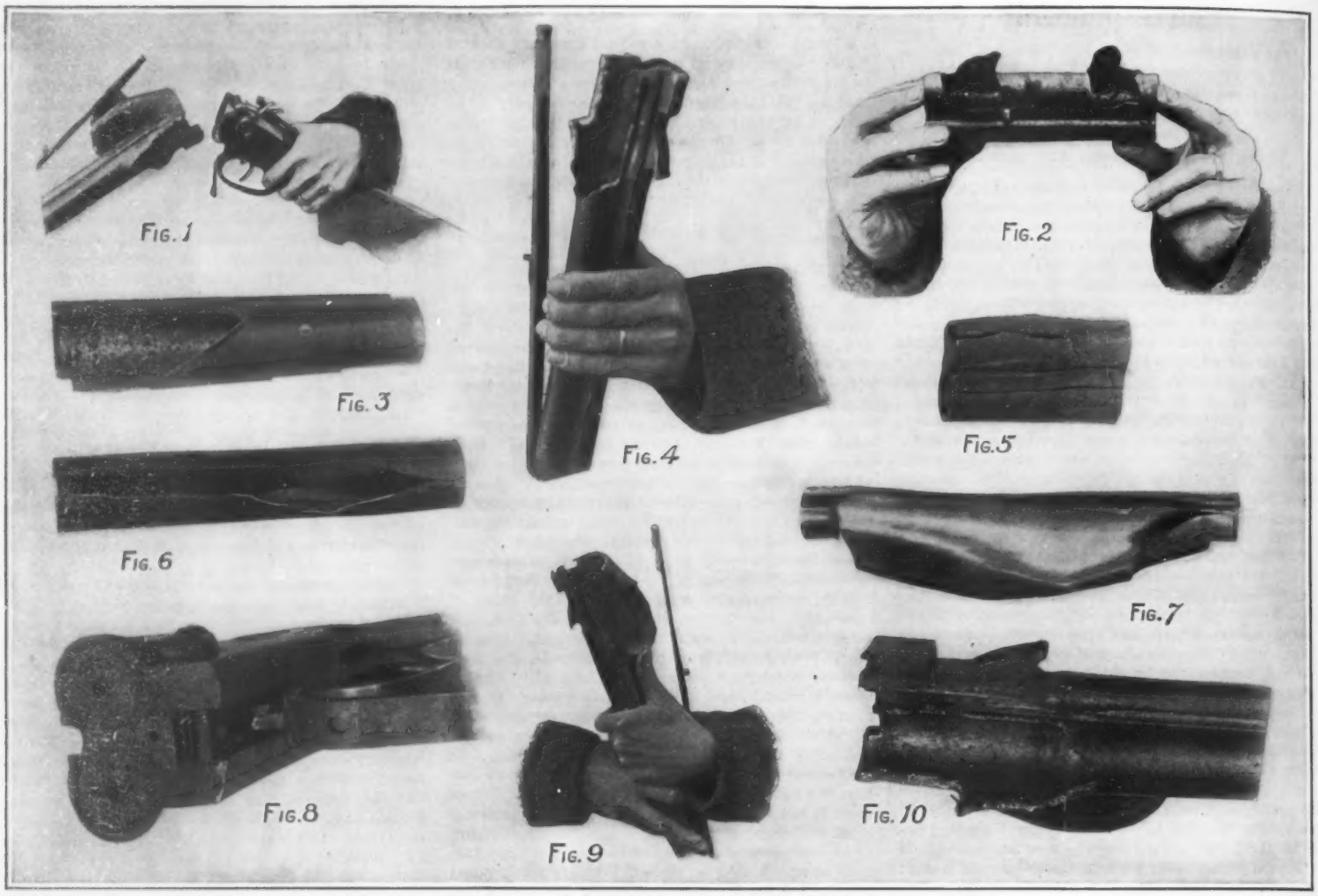


Fig. 1.—The wreck of a three barreled gun blown up with 60 grains of dense smokeless shotgun powder, which easily could have been loaded by error through a measure set for the standard load of "bulk" smokeless. Fig. 2.—A freak blowout, showing weakness of old style Damascus barrels. Gas burst out in two portions of barrel, choosing weaker portions and leaving intact stronger ribbon between. Fig. 3.—Portion of 28-bore barrel blown out through overload in chamber. Fig. 4.—Not a pleasant thing to occur when one is holding the gun. Fig. 5.—The chamber end of a double gun, blown up by overload. Figs. 6 and 7.—What happens when an obstruction is in barrel. Fig. 8.—The breech of a three-barreled gun, blown up by the writer. The rending force of the overload of dense shotgun powder blew the "flats" off the heavy frame in addition to blowing the barrel wide open. Fig. 9.—This barrel was blown up from some unknown cause, but unquestionably an overload. What would have happened had hands been around the torn portion? Fig. 10.—The heavy breech end of a barrel in which 60 grains dense smokeless was fired, apparently akin to a detonation; shot also broke off frame and blew hinge portion out of sight.

How Guns Are Blown Up

Destructive Effects of Overloads of Powder and of Obstructions in the Barrel

By Edward C. Crossman

OUT of ten guns that blow up, nine are probably shotguns. Out of the nine, eight let go without harming anything but the feelings of the shooter. However, the one chance in ten blowups for injury to the face or the fingers, when taken over the great bulk of guns sold annually in America, is sufficient to make worth while some dissemination among the proletariat of advice against the things that lead to the wreck of what was once a perfectly good gun and a perfectly good left hand.

Probably 90 per cent of the guns that blow up are blown up through obstructions in the barrel. Five per cent of the ten left are blown up through errors in loading the cartridge, often the errors of the shooter himself. Shotgun barrels, through consideration of weight and balance, are lightened nearly to paper thinness forward. Shotgun powders are tempered to the shorn barrels by being made to exert their great pressure in the first 10 inches of the tube, where there can be left a fair thickness of metal without prejudicing the balance of the arm. Where the chamber pressure of the 12-bore gun with normal load may run four long tons, or, in round numbers, 9,000 lbs. per square inch, at a point two inches from the breech of the gun, the same pressure fades away to about 400 lbs. at the muzzle.

While shotgun barrels of entirely normal proportions have been tried with gradually increasing loads until the pressure stood 40,000 lbs. per square inch, or four times any normal pressure, yet the forward section of the barrels so tried received no proportionate part of the excess, and their strength remained still in doubt. They bulge or burst readily from obstructions, whereas prodigious overloads can be employed without affecting them, merely because overloads do not greatly run up the pressures well forward in the barrel. When a charge of shot, or a bullet, moving down a gun barrel meets with an obstruction weighty enough to check its progress, usually the result is a barrel either bulged or burst. If the obstruction is pushed down to rest on the shot or bullet before the shot is fired, there is usually little effect. Hence the rise of the compressed air theory as the explanation for the damage done. No room between missile and obstruction, no blowup, save when the obstruction was made very heavy. Room between them, result either bulge or burst. As a matter of cold fact, of course, the barrel is far stronger at the breech, and so such tests are of little value as not throwing the strain on a part of the barrel weaker than that at the said breech. However, the same phenomenon was observed in barrels of the same thickness throughout, and it became evident that to damage the barrel, the shot or bullet had to get a running start on the obstruction.

Years ago, British authorities held that the air, compressed 'twixt missile and obstruction, did the damage. The argument waxed hot, and the great British sporting paper, the *Field*, set pressure plugs along a barrel and apparently determined the fact that the highest pressure fell between missile and obstruction, not behind the missile, where the powder gases were pushing.

It was probably from this that the silly theory, so commonly accepted among shooters, took rise; this, to the effect that if you "sealed" the bore of a gun you would blow it up at the next shot. Needless to say, a gun can be sealed with gold beater's skin, with sealing wax, or with a thin film of mud, not one of the three possessing any resistance so far as weight or grip on the bore is concerned. A thin bridge of snow across the muzzle of a shotgun is held by the superstition of the shooting clan to be sufficient to blow up the gun.

As a matter of fact, if the tube contains two inches or so of well packed snow from a fall or careless handling of the gun, to the eye the effect is the same as if it were sealed with a thin film of the same substance, and the two inches of packed snow is quite ample to blow up the gun. Hence well authenticated instances of a gun bore merely "sealed" with snow blowing up, and the perpetuation of the gray whiskered theory.

In my destructive career I have blown up many guns in the endeavor to see what makes 'em tick, and I have taken occasion many times to seal the bore of the condemned weapon, preliminary to other doings at this auto da fe, and to fire it to see if it would let go. In no case did the weapon burst or bulge the barrel from less than a fair amount of mud or other weighty substance, regardless of how carefully the air in the bore was segregated from the air outside by a careful seal. In the case of a service rifle of the Government, the New Springfield, we rammed the muzzle into a mud bank until the bore was most assuredly sealed, and contained an unknown surplus into the bargain. It blew out without harm to the bore. Only after we rammed it repeatedly into the mud, sufficiently to accumulate an inch or so of sticky mud, did the barrel burst, and then it split from muzzle to breech in two neat halves, as if one had sawed them with a hacksaw.

While the barrel is far stronger at the muzzle than is the barrel of the shotgun, the pressure also is far higher than is that of the shotgun, and the bullet arrives at the muzzle with the cruising speed of more than double the charge from the fowling piece. Less mud would have blown up the shotgun, but not merely enough to seal the bore. In other words, what blows up guns is weight of obstruction.

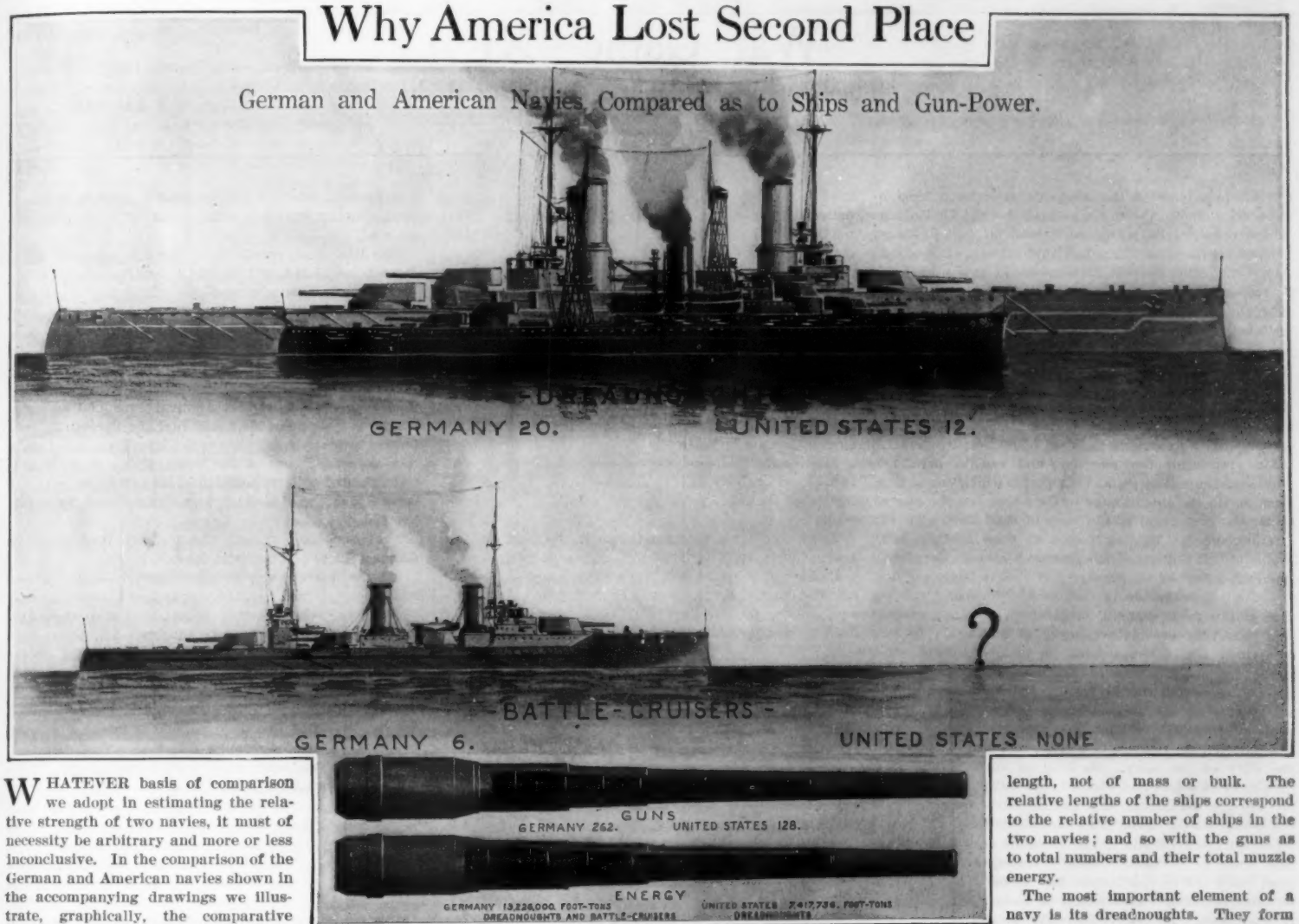
Ballistic engineers believe that guns are blown up through a violent wave action of the rushing powder gases, suddenly checked at the obstruction, and having almost the effect of a wave of detonation. There would seem to be a limit to the force than can be exerted by the compressed air, while within the strength of the gun barrel there is practically no limit to the strength of ordinary gunpowders. A single pound of modern bulk smokeless shotgun powder has the potential energy of 19 foot tons. That is, enough to raise 19 tons a foot.

Almost without exception a gun will blow up if it has its muzzle pushed well into a pool of water. Here, of course, the resistance of the water in the barrel, a non-compressible substance possessing weight, is akin to that of more solid substance. In the trench fighting

(*Concluded on page* 561)

Why America Lost Second Place

German and American Navies Compared as to Ships and Gun-Power.



The relative lengths show the relative strength of the navies in dreadnoughts, and in their guns and gun energy

WHATEVER basis of comparison we adopt in estimating the relative strength of two navies, it must of necessity be arbitrary and more or less inconclusive. In the comparison of the German and American navies shown in the accompanying drawings we illustrate, graphically, the comparative strength in number of ships, in number of guns, and in total gun energy. At best, this is but a rough-and-ready method; for to judge of the value of numbers we should know something of the size, speed, defensive qualities, fuel capacity, and ammunition supply of the individual ships; the distribution, arcs of fire, availability to train on either beam, and the weight and penetrative power of the individual guns.

To make an exhaustive study of the subject along such lines would be beyond the scope of the present article; but by way of suggesting what modifications of the mere totals given in our drawings would have to be made, we draw attention to the fact that although the German navy includes 26 completed dreadnoughts as against 12 completed in the United States fleet, the average displacement of the United States dreadnoughts is 25 per cent greater. That is to say, the average displacement of the United States dreadnoughts is 25,625 tons as against only 20,550 tons for the German dreadnoughts.

Now, unless some grave errors have been made in her design, a ship that is of 25 per cent greater displacement, is presumably 25 per cent more efficient than the smaller ship. The excess displacement will appear in a more powerful armament or more complete defensive elements such as thicker armor, or in both; or it will be seen in a larger fuel and ammunition supply; or in a more powerful motive power and greater speed. Hence we believe that ship for ship and date for date, our own dreadnoughts are more than a match for the dreadnoughts of the German navy. Given equally good handling and equal gunnery our "Pennsylvanias" and "Nevadas" should be more than a match for any of the German dreadnoughts, with the possible exception of the three latest ships of the "Ersatz Worth" class.

On the other hand, we wish to draw particular attention to the fact that Germany possesses in her battle-cruisers alone a division of ships capable of making from 28 to 30 knots, which would be a sore puzzle to the commander-in-chief of our relatively slow, 21-knot dreadnought fleet. He would be powerless to bring them to action; they could sink any of our slow and insufficiently-armed scouts we might send out to find the enemy; they could obtain full information of our movements without the least risk to themselves; and, if they elected to sink our merchant ships and raid our coasts, they could do so with impunity.

In the event that the German fleet brought our own to a general action, their numbers and the possession of a fast battle-cruiser wing would render the outcome of the action a foregone conclusion—always, of course, assuming that the maneuvering and gunnery were of equal quality. It is conceivable that our battle-line of 12 ships might find itself engaged simultaneously by a line of ten German ships on each beam. And the six battle-cruisers, by virtue of their high speed, could take position ahead of our line and by steering a zig-zag course, would be able to concentrate their broadsides against the head of our line. Thus, at the same time, our leading ships would be subjected to the concentrated fire of the whole 26 ships of the German fleet, and under that tornado of high-explosive shell, the head of our line would melt away like a bar of wax before a blow-pipe.

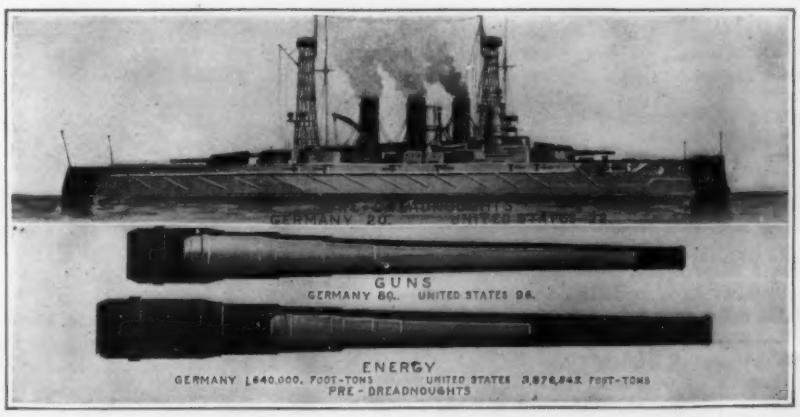
Referring again to our illustrations, it must be borne in mind that the comparisons are made on a scale of length, not of mass or bulk. The relative lengths of the ships correspond to the relative number of ships in the two navies; and so with the guns as to total numbers and their total muzzle energy.

The most important element of a navy is its dreadnoughts. They form the first battle-line and no judicious admiral will think of pitting his pre-dreadnoughts against an enemy's dreadnoughts. The winning of this first-line battle will in all probability mean the winning of the war. How then do we stand in respect to that navy which only a decade ago we surpassed in strength by a good margin?

Germany possesses 26 dreadnoughts, mounting 262 armor-piercing guns, whose total energy is 13,226,000 foot-tons; and against this mighty fleet we could oppose 12 dreadnoughts, mounting 128 guns, whose total energy is 7,417,736 foot-tons. And let it never be forgotten that against the six battle-cruisers included in that fleet, we could oppose not a single one.

When we come to the second line, composed of pre-dreadnoughts, the comparison is more in our favor; but lest we deceive ourselves (and it is to be hoped that our Congressmen will take careful note of the fact) we must carefully bear in mind that it is the dreadnoughts that will decide the naval campaigns of the future. Germany possesses 20 pre-dreadnoughts, mounting 80 armor-piercing guns (though it is doubtful if the 9.4-inch guns of the "Kaiser Freiderich III" and the "Wiliesbach" classes should be called "armor-piercers"), of a total energy of 1,640,000 foot-tons. Against these we could opose 22 ships, mounting 96 guns of far greater power, whose total energy is 3,876,545 foot-tons. Among the pre-dreadnoughts we have included the "Michigan" and "South Carolina," whose small size and low speed shut them out of the dreadnought class.

The great disparity in the gun-power of the two pre-dreadnought fleets is due to the fact that we started out right by mounting heavy 12- and 13-inch guns, whereas the Germans fell into the error of mounting light 9.4-inch guns in the belief that volume of fire was of more value than weight of fire.



Relative strength of German and United States navies in pre-dreadnoughts and in their guns and gun energy, shown by lengths of guns and ships

Molasses as Fuel

A GREAT Hawaiian sugar company has arranged to ship waste molasses to the Pacific coast where it will be burned as fuel and compete with California fuel oil. It would seem possible to ferment this molasses into alcohol and manufacture this product at a profit.

War Game—XI

The Defense Against a Landing Body

By Lieut. Guido von Horvath

THE principles of the offensive and the defensive tactics remain the same, no matter what kind of an action is considered. One party will attempt to force its will on the other. Against this attempt the second party will offer its best resistance. If this proves to be successful, the second party will undoubtedly undertake the same action to which he has just seriously objected. This means, in plain English, that "thou shalt do unto your neighbor what he intends to do unto you—but do it first."

In our present case the main difference rests in the fact that new elements are introduced hitherto not considered in our problems. These new elements are the sea and its shore as the field of action; war craft, which represent the effective and mobile artillery forces of the enemy; and transports, which carry the troops with the intention of landing them on the shore under the protection of the guns of their fleet. These last become the fighting forces as soon as they are landed. But until that moment they remain the most vulnerable part of the enemy.

A landing operation in face of a defensive force is one of the most difficult problems war can present. For this very reason, whenever a landing is to be attempted this attempt must be undertaken in great secrecy. Should conditions not permit this, it will depend for its success on the ruses and feints employed to hide the real purpose.

Primarily, the defense of a coast line is the duty of the navy. So long as our own navy is afloat and able to cope with the enemy, the chance of a hostile landing is very small. Even if an enemy could establish itself on shore, its communication would be in constant danger, its supplies could not be continuous, and sooner or later the land forces would be forced to surrender. Therefore, the navy must be accounted for before a successful landing can be made.

Now let us consider the vast coast line of the United States and let us study the points which would be most likely to play a part in warding off an enemy landing.

It is but natural that as soon as war is declared a coast-guard system will be established to serve as a precaution against surprise. The established coast defenses must see to it that commercially and strategically important harbors are well guarded by mine fields and, where necessary, by temporary field fortifications.

It is safe to presume that any operation directed against the coast line will threaten some important point. A thrust against the heart is the first rule of strategy, but often the indirect road leads to the aim quicker. Therefore, while a demonstration against the most important point is to be expected, the real blow might fall at an altogether different point.

Keeping this in mind, it is assumed that the line of observation along the coast will be continuous. With the aid of scout cruisers, naval patrols, aeroplanes and captive balloons, this ought to be a trustworthy line of security against surprise.

Besides this temporary arrangement, we must remember the regular land forces of the Coast Defense. These are the local military forces assigned to important harbors and fortifications.

The military preparations for the successful defense of the coast line of a country are the fortifications, the arrangements for rapid troop movements and the organization of forces to cover the entire coast line.

The fortifications are either permanent establishments or field works erected for the defense of important points.

For the transportation of the land forces all the available railways and other means by which the defensive troops can be quickly placed at the point of need must be utilized.

The organization of forces at strategical points demands a sufficient army to cope with the situation.

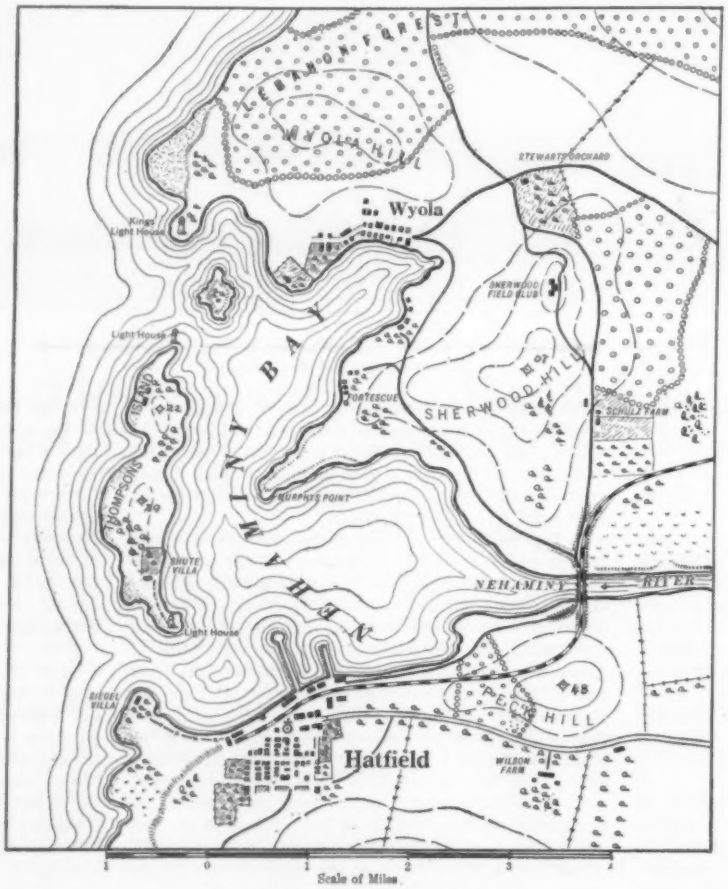
The main defense against harbor attacks is the Coast Artillery. These armaments are located in permanent fortifications where earth, concrete and steel works are used to protect the guns. The armament of the permanent fortifications consists of the first class, intermediate and the second class guns. The last two classes are generally rapid fire guns.

The first class armament includes the large caliber guns and the mortars. These are designed to attack armored vessels with their shot and shells and to disable, destroy or sink these vessels through the high explosives which such shells carry. The shot is intended for use against the main armor of a war vessel. Through its heavier construction it has greater penetrating power, and it acts as a mine. Shot has no fuse, but explodes through the sudden force of impact against the armor plate.

The intermediate class consists of guns from 4 inch to 6 inch caliber. Their purpose is the protection of the mine fields and the attack of unarmored boats.

The secondary armament is the 3-inch gun, and on account of its mobility is of the greatest importance.

Besides the guns and ammunition necessary for efficient coast defense, the fire control, power and light equipments, the wireless and signal communications are of great importance.



Map of Nehaminy Bay and vicinity

Gunnery in our days is a highly developed, scientific engineering feat, which demands the highest training in both men and officers.

The groups of guns placed in certain fortifications or their parts are known as "batteries." Several batteries, seldom more than three or four, are placed in the control of one officer and are designated as "fire commands."

We have here given an introduction to the new elements of warfare. We can therefore work out a problem of defense against an attempted landing by the enemy.

General Situation

July 15, 19—

After an indecisive naval engagement in the north, the Red fleet withdrew toward its base. The Blue fleet, by scout cruisers and aeroplanes, has ascertained the fact that the badly damaged cruisers of the "Alexander" class have reached port and remained there, but that the first battle squadron of Admiral A, with the dreadnought "Achilles," having coaled and provisioned, steamed away toward the northwest, and has been in wireless communication with a northern fleet, the strength of which was at that time unknown.

The Blue fleet, consisting of the 4th squadron under Rear-Admiral RA, put in at the Sullivan Bay coaling station and, having placed the "Icharian" into drydock, received the news that the 2nd squadron, with two dreadnoughts, was moving south to establish communications.

On the 16th of July, 19—, the Blue scout cruiser "Virgo" intercepted a wireless message from the Red fleet, which indicated that Admiral A's squadron sighted the northern Red fleet and that the fleets in a combined route are ahead toward Sullivan Bay. That same day an aerial scout of the Blues, flying at great altitude, sighted this combined fleet and returned with the report that the Red fleet was accompanied by transports.

That same day, at noon, the northern Blue squadron dropped anchor in Sullivan Bay.

In the afternoon, through another aerial reconnaissance, from the 4th squadron's fast cruiser "Menelaus," the wireless report repeated the news above given. Whereupon Admiral XA, commanding the entire Blue fleet, issued orders to steam against the oncoming Red fleet.

At 7 P.M. the Blue squadron sighted the Red fleet in battle line. A combat at long range followed. The Red fleet suddenly gave way, turned north, drawing the Blue fleet in its wake.

The approaching night ended the long-range encounter and the Red fleet steamed out of sight of the Blues.

Nehaminy Bay is located 92 miles south of the Sullivan Bay naval station, and is in direct connection with the Capitol, via the Hatfield and Alpine Railroad. Considering the importance of the channel and the deep harbor of Hatfield at the outbreak of the war, two batteries were erected for its protection.

In Pottstown a detachment, consisting of the 9th Infantry Brigade with two batteries of field artillery, one squadron of cavalry and one battalion of Engineers, has been concentrated for coast defense service.

The mining of the channels has been ordered, but not yet carried out.

One gunboat of the "Hawk" type, with two torpedo boats and a submarine of the second class, were detailed for service in Nehaminy Bay.

On the 17th of July, 19—, the Red fleet was sighted 150 miles north of Sullivan Bay, and another naval battle ensued at 10:30 A.M., in which swift cruisers only of the Red forces took part, drawing the Blue forces still farther north.

At 11:45 the Blue observation post at Thompson's Island reported the approach of a fleet, steaming east.

At 12:30 the fleet came into sight and its identity was established. The approaching enemy fleet consisted of one battle cruiser, a torpedo boat flotilla and three large transports.

From consideration of the course, it became evident to the observing station that the enemy fleet was headed toward Nehaminy Bay. The following telephonic report was sent to General G, commander at Pottstown:

"An enemy fleet, consisting of one battle cruiser, a flotilla of 7 torpedo boats and 3 transports of 4,000 tons each, steamed into sight at 12:30 P.M. Their course indicates the intention of entering Nehaminy Bay."

From these observations and reports it seems probable that the maneuvers of the Red fleet were designed to draw the Blue fleet away and thus give an opportunity for smaller scattered landing parties to gain a foothold on the Blue shore.

General G at Pottstown, having received the report, according to prearranged, plans, which were worked out for the defense of Nehaminy Bay, issues the following orders:

"Pottstown, July 17th, 1 P.M., 19—

"A small enemy fleet with 3 transports is steaming

toward Thompson's Island, apparently with the intention of entering Nehaminy Bay and landing forces on our shore.

"To prevent this landing, the detachment will march immediately to a point one mile north of the railway bridge crossing lower Nehaminy River.

"The cavalry, with one battery as advance guard, via temporary bridge alongside Hatfield Railroad, will occupy Sherwood Hill and patrol the shore north and south for 25 miles.

"Fifth Regiment of Infantry will follow immediately and take position in readiness behind Sherwood Hill. Second Battery will march with this regiment. The 6th Regiment will camp along railway and prepare for immediate embarkment. Engineer Battalion will entrain in first train for immediate departure. Fifth Regiment to supply flank guards 2 miles north and south of Sherwood Hill.

"Communication between the defensive shore line and headquarters will be established by the cavalry, and Colonel C will immediately put himself in communication with Coast Signal stations and the Fire Command at Sherwood Hill.

"The ammunition and supply trains will follow the regiment on the Wyola road.

"I shall remain with the advance guard.

"(Signed) General G.
"Commander of Pottstown Coast Guard Detachment."

Naval Developments

When the Blue observation station on Thompson's Island sighted the Red Navy and transports, the Red torpedo boats, in fan formation, slowly proceeded toward the northern entrance of the bay, followed by the cruiser and the transports.

The Blue naval forces at that moment were in the following position: The gunboat "Eagle" was at anchor behind Thompson's Island; the torpedo boat "Sphinx" was 9 miles north of King's Lighthouse, steaming south; the sister boat, "Isis," 2 miles south, homeward bound. The F-2, a mile west of Thompson's Island, after a signal exchange with the observation station, submerged in a westerly direction.

At 1:25 P.M. the "Isis" reached the cover of the island and dropped anchor 200 yards south of the "Eagle."

At 1:35 the enemy cruiser fired a shell at the approaching "Sphinx." The range was far too short, and the "Sphinx," with decks cleared for action, keeping close to shore, sped full steam ahead. Five minutes later another shot fell closer. At 1:45 P.M. the range was fairly well established by the Red cruiser. The "Sphinx" slowed down and steamed slightly seaward. The next shells fell ahead.

At 1:55 the "Sphinx" took full speed and in five minutes turned the point at King's Lighthouse and, untouched, entered the bay.

The next fire action on the enemy's part was at 2:10; a shell dropped into the bay; but the Blues paid no attention, either from the shore or from the gunboat behind Thompson's Island.

At 2:40 the enemy torpedo boats on both ends of their line dashed forward, one headed for the northern, the other for the southern entrance of the bay. Five minutes later the "Eagle" opened fire upon the nearest torpedo boat—the second shell was a hit and the southern Red torpedo boat was disabled. The "Eagle" then steamed slowly up and down behind the island, firing at intervals. When a second torpedo boat was hit the battle cruiser steamed forward and a random shot fell on the "Eagle's" deck, causing serious damage.

Utilizing the lull in the situation, the Red cruiser boldly dashed forward, and ten minutes later reached the entrance at King's Point. At almost the same time the first transport was torpedoed by the Blue submarine, but the effect of the explosion was not immediately felt. With the intention of beaching the sinking boat, it was sent forward at full speed toward the shallow waters near the island. Two torpedo boats stood by.

The Red battle cruiser, instead of keeping its course toward Murphy's Point, turned close inshore, when the hidden Blue coast battery from Wyola Hill opened fire.

Owing to the small caliber of the coast battery, its guns were silenced in 30 minutes.

(*Concluded on page 564*)

Guns That Protect Crops from the Ravages of Hailstorms

WHILE the guns of the European armies are thundering incessantly on many battlefields in their mission of killing men and destroying man's works, the

Placing powder charges in the brass shells for the anti-hailstorm gun

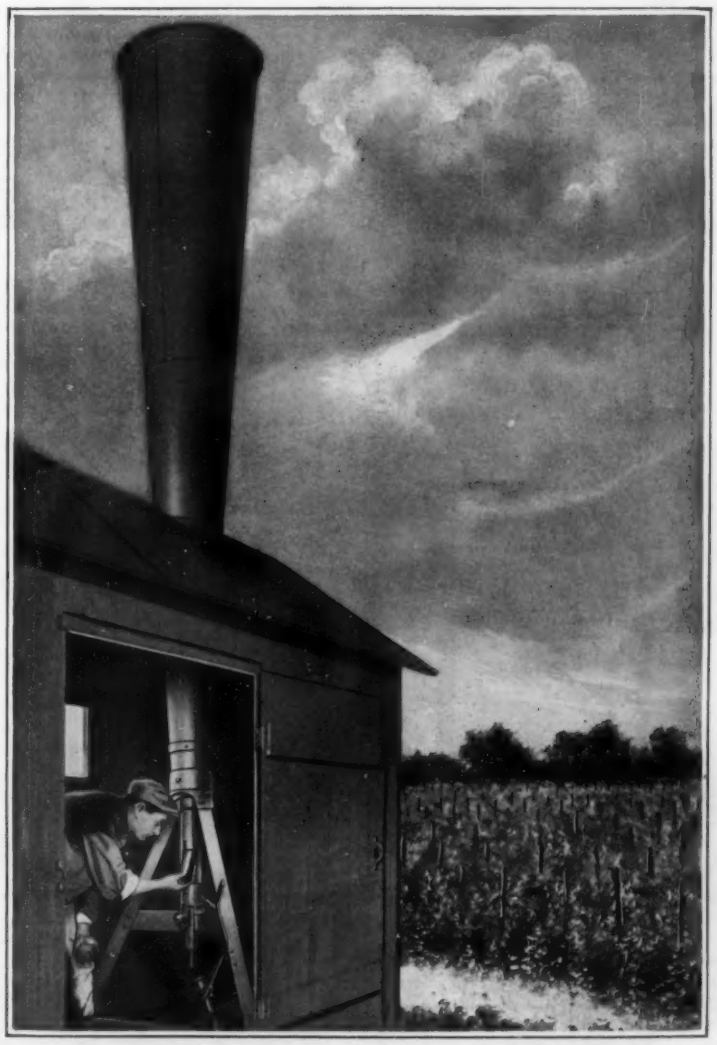
grape cultivators of France, in their turn, are using artillery to good advantage. But theirs is not destructive artillery: they are using guns only to protect their vineyards against the destructive effects of hailstorms, which are not infrequent in the grape-growing districts.

Anti-hailstorm guns cannot be said to be novelties in the strictest sense of the word, for they date back to 1896 when an Austrian named Stieger, who had had an opportunity of witnessing the devastation caused by hailstorms each year in certain districts of his country, conceived the idea of firing a cannon shot at the clouds charged with hail, using an artillery piece of special design. Stieger learned that as a result of artillery fire, directed against the clouds, the threatened storm moved elsewhere before bursting, thus saving the crops in the immediate vicinity of the anti-hailstorm artillery.

A short time later similar experiments were carried out in Italy, followed soon after by the introduction of this method of protecting grape vines and cereal crops in France. In the latter country the use of anti-hailstorm guns has been extended until to-day it is in general use, principally in the Bordeaux, Bourgogne, and Champagne regions.

A representative type of the anti-hailstorm cannon is composed of four main members: First, a tripod which serves to support the cartridge mechanism; second, a breech-loading mechanism which receives the cartridge and explodes it by means of a striking or firing pin; third, a smokestack or funnel which is a continuation of the breech-loading member and serves as an outlet for the gases; and fourth, a sheet of iron measuring three to four meters (9 to 12 feet) long, surmounting the cannon and passing through the roof of the shed that serves as a shelter for the cannon and its operators.

Following the discharge of the cannon, there escapes from the stack or funnel a whirling shaft of air which, according to a French authority, M. Vermoret, brings about certain changes in the atmosphere. The condensation produced by the discharge modifies the unstable electrical state of the hailstones that compose the clouds most feared by the agriculturists. Whatever may be the merit of these theories offered in explanation of the action of anti-hailstorm cannon, the fact remains that this odd artillery is serving its purpose well.



A typical anti-hailstorm gun used to protect crops in France. It consists of a breech-loading mechanism, a tripod, and a large funnel which passes out through the roof of the shelter

The Preparation of Frozen and Dried Eggs

THE frozen and dried egg industry, declares a new publication of the Department of Agriculture, is a permanent one because it meets a distinct economic need. Many eggs which could not stand long shipments may be preserved as wholesome food by freezing them out of the shell or by drying. In the beginning, however, there was a natural popular prejudice against the business, which was increased by the ignorance and carelessness of some of the pioneers. It was under these conditions that the Department of Agriculture undertook a study of the problem in order to lay the groundwork for a scientific preparation of an extremely perishable product. Some of the results of this study have just been published in a professional paper, Bulletin No. 224, "A Study of the Preparation of Frozen and Dried Eggs in the Producing Section."

The eggs commonly used by reputable firms for breaking are small or undersized eggs and dirty, cracked, or shrunken eggs. To the trade these are known as "seconds." They are not to be confused with eggs that are unfit for human use, such as the classes known as black, white, mixed, and sour rots, green whites, eggs with stuck yolks, musty and moldy eggs, blood rings, etc. These should be rejected entirely or else used for tanning purposes only. Eggs with a bad odor should be rejected absolutely.

Careful candling before the eggs go to the breaking room is one of the principal points upon the importance of which the new bulletin insists. Careful candling is not only necessary to prevent the use of unfit eggs, but it will also prevent the waste of a number of perfectly good eggs which might otherwise be rejected. In order to insure that the eggs are well candled, the bulletin recommends some system by which the work of the individual candler may be checked. Eggs that it is found difficult to grade should be set aside by the regular candlers for examination by an expert. Furthermore, the eggs should be graded again when out of the shell, for certain kinds of infection can only be detected when the eggs have been broken. When grading eggs out of the shell, only two grades should be recognized—food eggs and tanner's eggs.

The production of frozen and dried eggs is primarily an industry for the egg-producing sections. Many eggs that now reach the large consuming markets in a totally unfit condition could be saved and a large portion of the annual waste eliminated if they were treated in time.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Recent Improvements in the Transmission of Steam Through Underground Conduits

WITHIN recent years there has been a tendency in leading cities to replace individual heating plants with central power stations from which heat and power can be supplied to a large group of buildings. In many instances these central power stations distribute the heat to a number of consumers by means of hot water or steam passing through conduits laid beneath the streets, much in the same manner as the supplying of water and gas. But there is this difference, however, that in the instance of either hot water or steam the problem of conveying the heat involves a number of additional problems, prominent among them the provision for expansion and contraction of the pipes, and the maximum of insulation in order to minimize the loss of heat incurred in conveying the hot water or steam for any distance.

A conduit for the conveyance of steam, showing the expansion-compensating supports

A Southern manufacturer of clay sewer-pipes has lately evolved improved forms of conduit and supports for the proper installation of steam or hot-water pipes beneath streets in cities, or underground in country districts and in connecting various buildings of a factory group. For the sake of clarity, the conduit he has developed will be considered as consisting of two main members, the conduit proper and the supports within the conduit, which hold the steam or hot water piping.

The conduit is made and shipped in complete sections the same as sewer pipe, but the sections are provided with open, dipping scores on the inside and outside at two points diametrically opposite. The sections still intact are distributed along the conduit trench and then rattled into halves with a hammer. Along and beneath the outside scores is a joint-shelf for the retention of cement when assembling the companion halves, after the lower part has been laid and the heating pipe put in place upon the supports. For identifying the companion halves, suitable means of marking them are employed.

On all but very small pipes the supports are placed 10 feet apart. This introduces either three or four intermediate sections, which have no means of holding pipe supports, between the supporting sections. The number of intermediate sections depends upon whether the sections are 24 or 30 inches in length, or whether the pipe is so small as to require the supports to be less than 10 feet apart to prevent sagging.

The support sections of conduit are provided with two interior right-angled longitudinal ribs in the lower half; that is to say, in the half carrying the joint-shelves. The upper faces of these ribs are in the same plane; the other faces are parallel—standing vertical when the upper faces are level—and the ribs are far enough apart to give an ample roller base to safely support the sizes of pipe to be carried. The ribs are placed at a height which, added to the height afforded by the support, holds the pipe far enough above the bottom of the con-

(Concluded on page 563)

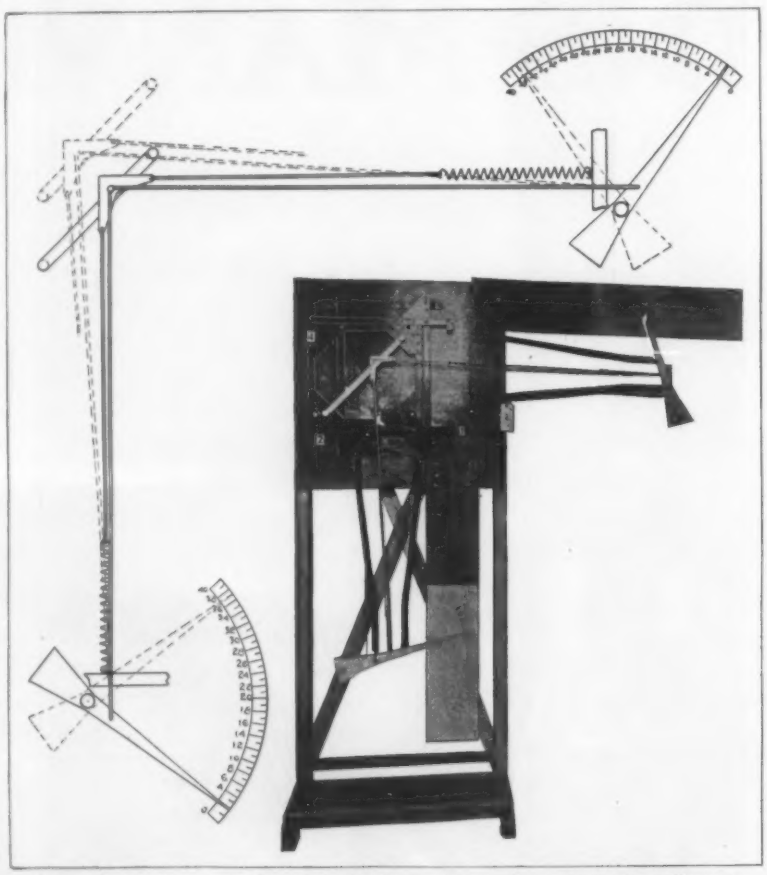
Soap Bubbles That Last for Months

SIR JAMES DEWAR, the famous scientist whose name has been closely associated with work on the liquefaction of the so-called permanent gases, researches at temperatures approaching the absolute zero of temperature, and the introduction of vacuum-jacketed flasks for the storage of liquid gases—the Dewar flasks which were the forerunners of the vacuum bottles of everyday use—has been conducting a series of remarkable experiments with soap bubbles at the Royal Institution of London.

A soap bubble blown by Sir James Dewar, which burst only after five weeks' time

Unlike the ordinary soap bubbles whose life is rated in seconds or possibly in minutes, the soap bubbles produced by Dewar last for several weeks or months. In a discourse on "Problems in Capillarity" it was desirable to use the thinnest possible membrane, for which purpose "black" soap film was selected. By the term "black" it is not meant that the film is black in color; quite to the contrary, it is perfectly transparent, although it appears black in reflected light. The question arose whether soap bubbles were intrinsically unstable or whether they merely collapsed because of contamination by either the liquid used or the air. By way of answer Dewar placed a bell jar 9 inches in diameter on the lecture table, and near the bottom of the jar placed a "black" soap film to form a perfect horizontal partition. A bubble was then blown inside the bell jar.

On Friday evening, March 24th, after a record career of more than five weeks, the soap bubble burst. It had been on exhibition at the laboratory of the institution and attracted a large number of visitors. It is believed that the bubble would have lasted for a much longer period had it not been for the vibration of the laboratory engines producing liquid air. Dewar has blown other soap bubbles which have had unusual life.



The demonstrating machine used during the Perlman infringement suit to illustrate the dual action of the wedging bolts, and a diagram of its operation

This device is used by Mr. Perlman to exert force radially and laterally both in expanding the rim on the wheel and in locking it laterally to prevent displacement. No matter whether the operator of the machine slides frame 4 sidewise or vertically, the two indices give the same reading, thereby indicating that deliberate effort in one direction exerts through the wedge member a force of identical measure in a direction of right angles.

How an Inventor Successfully Conducted an Infringement Suit

THE final adjudication of the Perlman patent covering a demountable rim is encouragingly illustrative of the present trend of the bench. The patent was originally filed on May 21st, 1906, and was continued by a subsequent application made on the 29th of the month following. The patent was granted only after nearly seven years of argument and reargument in the United States Patent Office and the United States Circuit Court of Appeals of the District of Columbia, and finally issued on the 4th of February, 1913. It took that period for the inventor, Louis H. Perlman, and his attorneys to enlighten the official mind and satisfactorily to demonstrate that certain seemingly simple structural features were capable of producing novel mechanical effects. The puzzling aspect of the matter is the involved commercial conditions arising from the fact that many thousands of demountable rims for automobile wheels were in service before Mr. Perlman's patent issued in 1913. Millions of dollars were actually invested in the manufacturing plants engaged in turning out these up-to-date aids to convenience and pleasurable touring.

When Mr. Perlman's patent issued three years ago, he found that he had a hard road commercially ahead of him even though the courts had sustained the originality and the priority of his invention in all particulars. Legally, he had a controlling patent, but even so he had to fight to win the fruits of his ingenuity. Therefore, he sued the biggest concern engaged in the manufacture of demountable rims. Suit was entered in October of 1913, and not until the 8th of March of the present year did the courts finally uphold the patentee and issue an injunction against the infringer. The long-drawn-out prosecution of the patent in the United States Patent Office and the protracted contest in the Federal Courts cost the inventor heavily; but he was convinced that he would win in the end, and therefore made sacrifices and battled on undaunted.

From a technical standpoint the conduct of the suit, especially in its concluding stages, has been both instructive and interesting because of the skillful manner in which it was handled. It was

(Concluded on page 563)

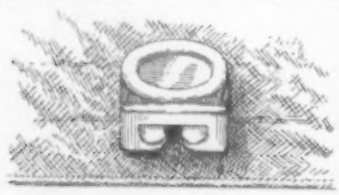
RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel

HOOK AND EYE.—E. B. TILTON, Jr., care of J. S. Larkin, 66 E. 56th St., New York, N. Y. This invention has for its object to provide a hook and eye which may be locked by pushing the hook within the eye and which will not unlock until the hook is depressed by a tongue which extends therefrom, the hook and eye being very simple in construction and without ends which might become entangled in the material to which the hook and eye are secured.

BUTTON PROTECTOR.—W. M. BARNES, 681 Tremont St., Boston, Mass. The construction in this case is adapted to fit over a button and pinch the retaining member therefor or the button itself, as desired, so as to protect the button against accidental breakage. The



BUTTON PROTECTOR.

invention provides a protector for buttons formed with a slot merging into a recess which accomodates a button, the protector being adapted to prevent the accidental breaking of the button when beating a garment carrying the button.

HOSE SUPPORTER.—C. J. HAUSEN, 368 W. 50th St., New York, N. Y. The object of this invention is the provision of a new and improved hose supporter, arranged to securely grip the hose without danger of tearing the same and to allow of conveniently engaging the supporter with the hose or disengaging it therefrom.

COLLAPSIBLE GARMENT HANGER AND COLLAPSIBLE BRUSH THEREFOR.—W. M. STIEBRITZ, 465 Jamaica Ave., Astoria, L. I., New York, N. Y. The invention provides a construction wherein the hanger is collapsible or foldable and the brush is likewise collapsible or foldable. It provides a construction which may be easily and quickly folded to every space whereby the same is adapted to easily fit in the pocket of an ordinary coat.

BUTTONHOLE.—A. L. JOHNSON, care of The Pacific Knitting Mills, Inc., 163 Jackson St., Seattle, Wash. This invention provides a buttonhole that will permanently maintain its form and original size during the life of the garment, and which is particularly adapted for use in knitted goods or other fabrics which are in themselves subject to stretching and afford a relatively unstable foundation for the stitches comprising the buttonhole.

Pertaining to Aviation

HOVERING FLIGHT AEROPLANE SYSTEM.—J. MCCURRY, 4406 Franklin Ave., Philadelphia, Pa. This inventor provides an aeroplane system comprising a platform for supporting passengers, this platform being suspended from aeroplanes flying in the air and having such movement relatively to each other and to the earth as to enable the platform to hover in the air. By this means passengers supported by the platform are maintained if desired at a particular point for a long time.

Electrical Devices

SOLENOID SWITCH.—E. GENGENBACH, care of Shore Instrument Mfg. Co., 555 W. 22nd St., New York, N. Y. The invention relates to an electro-magnetically operated switch and more particularly to solenoids of the iron-clad type. It simplifies and improves the operation of the devices referred to so as to be reliable and efficient in use and so designed that the housing in which the solenoid is mounted may be made of sheet metal.

ADVERTISING DEVICE AND THE LIKE.—H. K. HARRIS, Park Mansions, Knightsbridge, London, England. The present invention relates to means by which an apparatus which is termed a "selector" and which is provided in connection with each frame or the like at the exhibiting station is set according to requirements in such a way that when the band or other equivalent device in the frame is set in motion or released, it is automatically stopped by the selecting apparatus when it comes into the proper position for exhibiting the required letters, numeral, device or the like.

SUPPORT AND GUARD FOR TELEPHONE WIRES.—G. W. WELCH, Decorah, Iowa. In the present patent the invention relates to means for the support and protection of telephone wires crossing under high voltage electric transmission lines, the purpose being to prevent the broken high voltage wires from making contact with the telephone wires.

Of Interest to Farmers

PEA THRESHER AND HARVESTER.—G. E. PRITCHARD, Elizabeth City, N. C. This thresher and harvester is of the type of machine, an example of which forms the subject of United States Letters Patent, No. 1,117,904, formerly granted to Mr. Pritchard. The prime object of the present invention is to improve threshers of the indicated character, particularly with reference to the simplicity and efficiency of the beating or threshing means and the actuating means therefor.

SILO BLOCK.—L. MCNUTT, 28 S. Walnut St., Brazil, Ind. This improvement provides a construction of block of plastic material capable of hardening and a method of reinforcing the individual blocks and locking them together in superposed courses to form a circular wall capable of resisting any reasonable expansion stress.

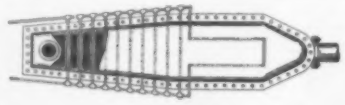
GRAIN SHEAF SHOCKER.—J. P. HIEBERT, Route 3, Box 100, Hillsboro, Kan. The device may be attached to a grain mowing and binding machine so as to travel therewith, and to receive the sheaves of bound grain as they are discharged by the binder. Carriers carry the sheaves of grain rearwardly and deposit them closely together thus forming the shock. The carriers are operated from the driving mechanism of the mowing and binding machine.

Of General Interest

SELF-LEVELING BERTH.—R. H. HARMAN, Box 194, Chester, Vt. This invention relates generally to berths for use on ship-board, and more particularly to a self-leveling berth, the object being to provide a berth having a relatively short swinging movement as compared to that of the adjacent tilting or swinging parts, and having in addition thereto a laterally tilting movement by which it is maintained in a level position at all times.

TOOTH BRUSH HOLDER.—G. LUNDY, 109 S. Warren St., Madison, Wis. This invention provides a tooth brush holder having walls, and a cover which extends beyond the walls but does not contact therewith at all points, so that there may be a circulation of air within the holder, to dry the tooth brushes which are inserted at the open bottom of the holder, and are supported on a rack within the holder.

FILTERING PRESS.—G. BROWN, 84 W. 33rd St., R. 44, Y. M. C. A., Bayonne, N. J. In this case the invention has reference to

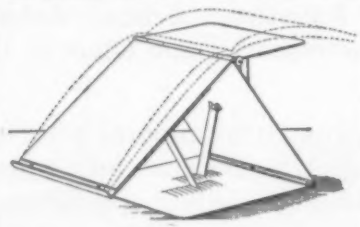


FILTERING PRESS

filtering presses and relates more particularly to a press whereby wax can be separated from mineral oils. The object of the invention is the provision of a simple, strong, inexpensive, and efficient filtering press whereby wax can be separated from oil continuously, and not periodically as is done now.

BARREL FOR SHOTGUNS AND RIFLES.—F. B. WARNER, 96 Chambers St., New York, N. Y. The object here is to provide a new and improved barrel for shotguns and rifles which is highly ornamental in appearance, is not liable to become pitted through the action of nitric or other acids incident to the use of smokeless or nitro powders in the shells fired by the gun or rifle.

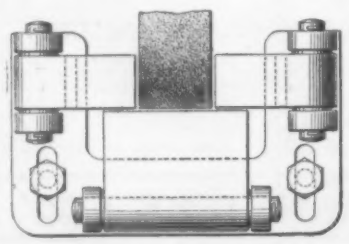
COPY HOLDER.—J. MCNAMARA, 150 Nassau St., New York, N. Y. The object of the invention is to provide a new and improved copy holder for the use of stenographers and other persons, and arranged to permit its use



COPY HOLDER.

on a table, desk, or other support with a view to hold a note book or other copy in a position desired by the copyist for conveniently copying the matter from the copy.

EMERY WHEEL REST.—R. E. HOUGHTON and M. J. HANLON, Cliftondale, Mass. This invention relates to emery wheel rests, and the object thereof is to prevent the jamming of the tool between the rest and the wheel, which

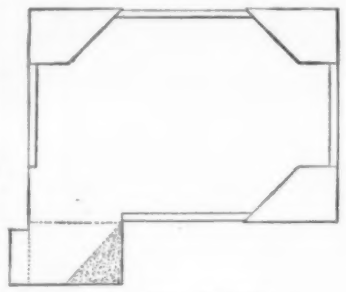


EMERY WHEEL REST.

causes the breakage of the emery wheel and frequent injury to the workmen. It provides a simple, convenient, strong and easily adjustable rest for emery wheels and whereby working on the wheel is rendered safe.

CIGARETTE CASE.—A. A. MITCHELL, care of Woods & Chatteller, Inc., 315 5th Ave., New York, N. Y. This invention provides supports for individual cigarettes, for holding the same in spaced relation to the sides of a folding case; provides supports to prevent rotation of the cigarettes; provides a mounting for said supports; and provides means for spreading the sides of the case and for maintaining the medium relation of said support thereto for all degrees of spread thereof.

BOOK COVER PROTECTOR.—G. FORTUNE, Cincinnati, Ohio. This invention relates to book protectors for the backs and covers of books, and one of the principle objects of the



BOOK COVER PROTECTOR

invention is to provide a simple protector of fabric or tape of strong paper, and in different sizes, said protector having pockets at the corners for receiving the corners of the cover of the book, thus providing a protector which is easily connected to the book, and which will extend entirely over the back and cover of the book.

SAFETY BOTTLE.—C. H. RUEGGER, 128 Henry St., Hasbrouck Heights, N. J. This improvement provides a structure which will always indicate to the purchaser whether or not the original contents is in the bottle. It provides a bottle with a neck and breakable top portion and a filling aperture at the bottom.

LEAF FOR SAMPLE BOOKS.—C. GREEN, 78 Walker St., New York, N. Y. Mr. Green's invention relates to devices for displaying samples, and more particularly to a sample book of the "loose-leaf" type, and it produces a flexible leaf so constructed that the samples may be mounted upon one or both members thereof as desired.

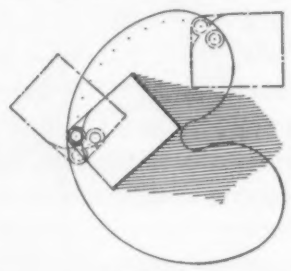
PICTURE FILM PERFORATOR.—H. A. WISEMAN, 311 Sackett St., Brooklyn, New York, N. Y. Among the objects of this invention is the provision of a combined moving picture camera and punching device, said punching device serving not only to perforate the film, but to actuate the film in step-by-step movement with respect to the camera lens.

BOTTLE STOPPER RETAINER.—H. V. CLAUSEN, 29 Broadway, New York, N. Y. The main purpose here is to provide means for holding the seals in such manner as positively to compel the cutting or breaking of the ribbon, twine, or wire, whereby use thereof, after once opening the bottle, is positively precluded, thereby preventing the re-use of the bottle by dishonest persons in an effort to vend a spurious article under the label of the original commodity.

Hardware and Tools

WRENCH.—D. O. BRUNNER, S. 2916 Division St., Spokane, Wash. An object here is to provide a wrench in which approximate adjustment of the jaws may be effected by a sliding movement, and in which an effective gripping action of the jaws on the work will be automatically effected by a bodily pivotal movement of the two jaws and the adjacent portions of the respective shanks.

PUNCH GAGE.—C. S. CHRISTENSEN, Christiania, Norway. This invention has reference to punches for making detents in desired articles, and has particular reference to



PUNCH GAGE

providing a punch for forming the drill centering holes in metal being formed into a die, and the main object thereof is to provide a gage for the punch which will insure uniformity in the distances of the centering holes from a given line and from each other.

LATCH LOCK.—K. PRAZMO, 346 E. 9th St., New York, N. Y. This invention relates particularly to locks of that type in which the bolt is capable of being thrown from the normal latch position to locking position, or vice versa, by a key. It provides a novel form of stop catch for the bolt, whereby the same can be locked against movement in either normal or unlatched position.

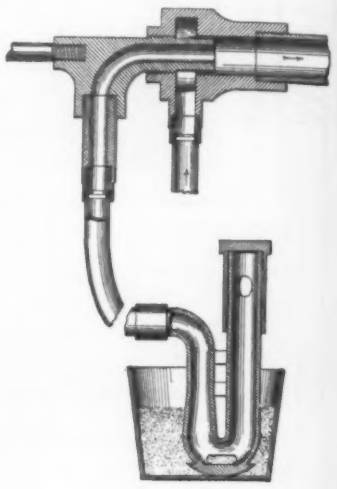
Heating and Lighting

GENERATOR.—L. E. HOWARD, Yamhill, Ore. This invention provides a generator for generating acetylene gas from a mixture of calcium carbid and water, wherein a generator is provided comprising a container for holding water, and having means above the water for feeding carbid to the water in the container, and wherein a gasometer is arranged adjacent to the container to which the generator delivers, and wherein the feeding of the carbid to the generator is controlled directly by the movable part of the gasometer.

GAS HEATER FOR FURNACES.—F. KORN, care of W. Korn, 120 Center St., New York, N. Y. This improvement provides a heater adapted to heat the water in a jacket surrounding the fire space of a boiler; provides a heater and means for controlling the same to maintain at relatively small gas expenditure the initial heat produced by the heater; provides means for more fully graduating the heat maintained in the fire space of a boiler; and provides ring heaters having means for introducing the fuel at opposite ends thereof.

ODORLESS CREMATORY.—A. C. FELTON, JR., address Nye Odorless Crematory Co., Georgia Casualty Bldg., Macon, Ga. An object of the invention is to provide an efficient device, this efficiency being obtained by utilising the heat of certain gases which would otherwise pass up the flue or chimney, by conducting these hot gases underneath the night soil pan of the crematory, before the products of combustion are permitted to escape.

BOILER FLUE CLEANER.—A. R. UHRIG and F. P. UHRIG, 7808 Quincy Ave., Cleveland, Ohio. In this invention use is made of an apparatus for forcing a mixture of steam, air



BOILER FLUE CLEANER

and sand through a flue to clean the same, the apparatus including a steam injector connected with a source of steam supply and a sand and air suction device connected with the said injector and with a sand supply and a sand and air suction device connected with the said injector and with a sand supply and with the atmosphere to cause sand and air to be drawn by the action of the steam into the said injector to be forced by the steam into and through the flue or pipe to be cleaned.

FIRE POT FOR STOVES AND FURNACES.—A. OHNEMUS, care of Excelsior Stove Mfg. Co., Quincy, Ill. The invention relates more particularly to a fire pot, the object being to provide a fire pot in the use of which the hydrocarbons escaping from fresh fuel will be better consumed within a stove or furnace, and the waste of heat units, so often amounting to a considerable percentage of the total heat efficiency of the fuels, may be reduced to a minimum.

RADIATING FIRE BOX FOR FIREPLACES.—A. A. JANNEY, 728 South Perry St., Montgomery, Ala. This improvement has reference to open fire places for dwellings and other buildings, and more particularly to a box so constructed as to provide a heater for feeding a constant supply of heated fresh air to a room and also utilizing a large percentage of heat which would be ordinarily wasted.

Household Utilities

FLY SWATTER.—A. R. LAUBENSTEIN, Ashland, Pa. This improvement provides a fly swatter arranged to permit the handle and the swatting member to readily assume angular positions one relatively to the other to cause the swatting member to lie flat on the surface on which a fly or other insect is swatted, thus preventing the escape of the fly or insect.

PIE CRUST CRIMPER.—M. R. BECKETT and W. J. RITTER, address the latter, Wilcox, Pa. This invention provides a pie crust crimper by means of which the crust of a pie may be readily and permanently crimped, and marked to indicated points at which cuts should be made for dividing the pie into equal parts, means being provided on the crimper for accommodating any bulging which might occur in the upper crest as a result of overfilling the pie.

FLUSHING DEVICE.—N. J. GONDOLF, 703 State St., New Orleans, La. The improvement resides principally in a retaining means to engage the float-carrying structure and retain the float in depressed position, to prevent the float from rebounding, without the employment of adventitious locking means, the continued lowering of the float due to the emptying of the tank, serving to release the float from the retainer, leaving the float free to rise as the tank again fills.

MILK BOTTLE HOLDER.—R. T. UNDERWOOD, 1355 Maryland Ave., N. E., Washing-

(*Concluded on page 562*)

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How Guns Are Blown Up

(Concluded from page 554)

of the great war, without doubt, hundreds of rifles have been ruined by getting enough mud in the barrel to bulge or burst it.

In the case of the shotgun, while practically every obstruction that occurs in the barrel enters from the muzzle and is the result of carelessness, yet there is the possible exception of a wad turned sideways in the loading of the shell, driven only part way up by the failure of the powder gas to exert full strength upon it, and then sticking in the choke. A quarter-inch felt wad turned squarely across the tube at the choke offers enough resistance conceivably to check the shot and set up wave action of the gases at a very thin part of the tube.

There is also the very possible and grave contingency of the accidental loading of a 20-bore shell into a 12-bore gun, in which event the smaller case slides down the tube until it fetches up at the choke. Needless to say, the resistance of a fully loaded 20-bore case, with its rim held at choke and refusing to go farther, is ample to blow up a barrel, and even though the gun be cylinder bored, the weight of the obstacle is ample to blow up the barrel. The danger is particularly great in the case of the man who owns both 20- and 12-bore guns and carries shells for both in the same hunting coat. It is so great that despite years of familiarity with firearms and with this very accident, I have twice dropped a 20-bore shell into a 12-bore chamber and had it slide down the barrel out of sight. Luckily, the error was detected immediately.

In England the accident grew so common that attempts were made to have all 20-bore cases colored black by legal action, to guard the shooter against this error, with its never failing results, if a 12-bore case is then loaded under the impression that no shell had been put into the gun, and the shot is fired.

The overload route to destruction is less peopled. There is in the shotgun situation the unhappy phase of two sorts of smokeless powder, one loaded bulk for bulk with the old black powder, giving the same ballistics, taking up the same room, and because of its bulkiness, obviating any possibility of overload without showing in the lack of room for wads and shot. The other is "dense," close kindred to high power rifle powder, very powerful and taking up little room. It is loaded by weight in special shells, and for the 12-bore gun 24 to 26 grains is the standard. So little room does it take that a double load can be put into a case adapted to bulk powder and the difference not show at all. If some tyro gets hold of a can of this powder and goes to loading it through a bulk powder measure as he has been loading bulk smokeless, he gets an overload of more than twice as much of this dense stuff as can be safely shot in the gun, and the result is hard on the gun, and possibly on fingers, because then the blowup occurs well back on the barrel.

While it is perfectly possible to blow up a gun through straight excess of pressure produced by smokeless powder burning naturally and doing its work normally, yet most blowups from overloads come from abnormal action of the powder. Smokeless possesses the peculiarity that if subjected to more resistance than that for which it is calculated, and so burning under far higher pressures than normal, it may cease to burn at a rate comparatively slow, with its gradual evolution of gas, and instead detonate.

Detonation means the instant ignition or breakdown of the powder into its gaseous elements by a wave through it somewhat akin to vibration or the transmitting of sound through a solid substance, like an iron pipe. Instead of burning normally and progressively, the entire charge is instantly resolved to its greatest possible volume of gaseous elements with tremendous pressure, and naturally the rending of the containing walls

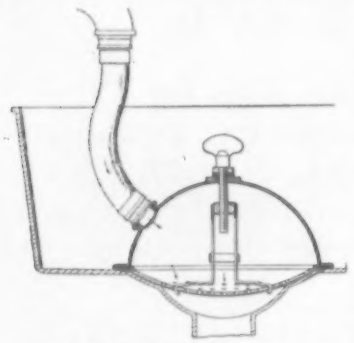
(Continued on page 563)

(Concluded from page 560)

ton, D. C. The invention has for its main or principal object the provision of a device of simple construction, and one which is easy to apply to the doorway of a house and which can be cheaply made and sold. The device is sanitary and out of the reach of prowling marauders, such as cats, dogs and the like.

CONVERTIBLE BED.—L. B. JEFFCOTT, 250 W. 15th St., New York, N. Y. This invention provides a convertible bed arranged to permit of conveniently extending the parts lengthwise to form a bed or to fold the parts to take up little room and to allow of using the bed when in folded position as a davenport or a divan, at the same time making provision for convenient storing of the bedclothes or other articles.

DRAIN AND WASTE PIPE CLEANER.—W. J. CROCKER and DE LANCE WALLACE, P. O. Box, 1574, Spokane, Wash. This invention provides a means whereby waste and drain



DRAIN AND WASTE PIPE CLEANER

pipes leading from sinks, wash basins, bath tubs and so forth, may be readily cleaned by the removal of obstructions therein, and in a short time and without any special amount of exertion and without the requirement of special tools and of skilled labor. It affords means whereby a direct water passage from a faucet or other water supply under pressure, may be established to the waste pipe or drain pipe, whereby water may be forcibly flushed through the latter so as to carry away any obstruction.

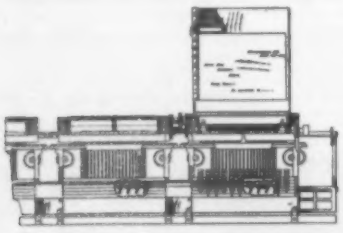
Machines and Mechanical Devices

BALL BEARING.—E. OLDFIELD, 535 Main St., Norwich, Conn. This improvement consists of washer-like separators, interposed between the balls, each of said separators being hung centrally, and loosely on the pins or rivets that connect the said rings or plates in such manner that each separator is free to adjust itself to the varying positions assumed by the balls on either side of said separator.

LOLLYPOP MACHINE.—H. W. ERNY, 75 Fulton St., New York, N. Y. The invention provides a machine for manufacturing lollypops, the machine comprising means for molding the lumps rapidly from a mass of material, and at the same time each lump is being formed a stick is forced into it, the operation continuing rapidly at a constant uniform speed and producing a uniform product.

CUTTING ROLL.—R. BURTON, 26 Carmen St., New Brunswick, N. J. The inventor provides a cutting roll in which the steel cutting knives are set or driven into the peripheral face of a wooden core, the core having metal foundations for the back of the knives to rest on, so that the knives are held against inward movement, thus maintaining the cutting edges of the knives in true circular shape.

DUPLICATING DEVICE FOR TYPE-WRITING MACHINES.—H. W. MORLEY, Angola, Ind. An object of this invention is to pro-



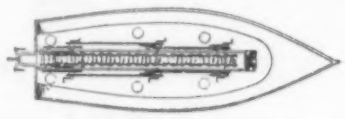
DUPLICATING DEVICE FOR TYPE-WRITING MACHINES.

vide a device for duplicating the work done on a type-writing machine, which dispenses with the necessity of using carbon copies, thereby eliminating the time necessary in inserting and taking out carbon paper, eliminating the cost of the carbon paper and doing away with the possibility of soiling the hands of the operator by the handling of the carbon paper.

MITERING MACHINE.—G. M. REPP, care S. L. Parsons, 45 Rose St., New York, N. Y. Among the objects of this invention is to provide a machine with delicately adjusted gaging devices for the manipulation of a plurality of blanks such as rules or slugs of metal and sawing or mitering the ends of all of them at the same time and in a precisely uniform manner.

WINDING DRUM FOR GLASS-DRAWING APPARATUS.—S. B. HENSHAW, care of Charleston Window Glass Co., Charleston, W. Va. This invention pertains more particularly to a winding drum forming part of the hoisting mechanism, the cable of which is connected to the vertically moving cage operating above the well or drawing chamber of the glass furnace and upon which the bait is seated to draw a cylinder of glass from the well just mentioned.

PROPELLING MECHANISM FOR BOATS.—J. H. MOON, 406 E. 11th St., Portland, Ore. This invention relates to an improvement in boats, and more particularly to an improvement in the propelling mechanism of a vessel. It provides an endless propeller in the form generally of a chain having blades movable into different positions for acquiring the most advantageous results when moving through the water, said blades being adapted to auto-



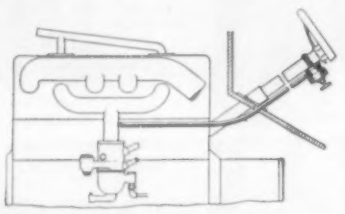
PROPELLING MECHANISM FOR BOATS.

matically assume the proper positions whether the chain be drawn in forward or in reverse position. It provides a propelling mechanism including an endless propeller chain and including means for manually transmitting power to the chain. River boats equipped with the propeller can run in the summer season when the water is so low that the double keels will "bobble" on the bottom of the river without injury to the propeller and at the same time the propeller has full power to drive the boat. The patent for this propeller is pending in the Canadian Patent Office.

UNIVERSAL JOINT.—E. S. ROBINSON, 5308 Bryant Ave., Oakland, Cal. This invention has particular reference to the manner of joining the sections of the housing thereof together. It provides efficient means for joining the sections of the housing together whereby relative movement therebetween and resultant injury to the fastening bolts is prevented.

Prime Movers and Their Accessories

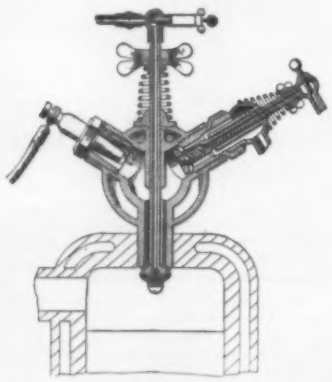
EXHILARATOR FOR COMBUSTION ENGINES.—H. P. MERTEL and E. WENDLAND, Address the latter, 815 Syms St., West Hoboken, N. J. This invention provides means for admitting atmospheric air to the manifold of the engine and intermediate the explosion chambers and carbureter thereof, for increas-



EXHILARATOR FOR COMBUSTION ENGINES.

ing at will the air content of the fuel charge; provides means for manually varying and controlling the proportion of air included in the charge; provides means for controlling the proportion in the manner mentioned in position convenient for the operator; and provides means for dissipating the effect of a back fire of the engine.

IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES.—F. V. EASTMAN, 109 Ind Ave., South St. Petersburg, Fla. This invention provides a device by means of which cheaper fuel oils for operating internal combustion engines may be used without the



IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES.

usual ignition troubles heretofore arising from the use of such fuels. It prevents the deposit of carbon which ordinarily occurs in internal combustion engines of the common type; and provides means for preventing the disastrous effects of moisture upon the ignition system.

MIXING VALVE.—G. S. VAUGHN, Franklin, Pa. The invention pertains to mixing valves for explosion engines, and the object thereof is to provide a valve wherein the size of the opening through which the gas passes can be varied to suit the particular conditions under which the engine will have to operate.

ENGINE.—L. H. R. ROGGE, Bernheimer, Mo. This invention is of particular value in connection with power engines using steam, gas, air or other elastic medium. It comprises an engine cylinder built up in sections, each adapted to be inflated and deflated, so that the cylinder as a whole expands and contracts and thus applies power to a crank shaft or the like.

Railways and Their Accessories

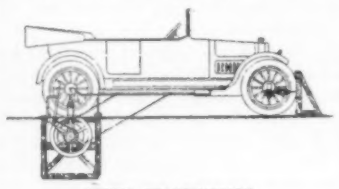
POWER REGULATING DEVICE FOR BRAKES.—C. C. LAYMOND, 518 Miami St., Marion, Ohio. The present invention has reference to braking connections for railway and other vehicles, and more particularly to a construction for automatically increasing and decreasing the amount of power applied to the brakes themselves in conformity with the load in the car.

TRAFFIC CONTROL SEMAPHORE.—A. A. ANDERSON, 80 W. 40th St., New York, N. Y. This improvement provides a traffic signaling apparatus, which may be seen at a distance; provides the apparatus with movable members adapted for arrangement in correspondence with the movements understood as signifying certain intentions on the part of the operator thereof; provides a semaphore with a plurality of arms, provided each with indicating means visible at night; and provides an apparatus with means for transmitting visible signals to a distant station.

RAIL JOINT.—R. T. BAGBY, Mascot, Tenn. The inventor utilizes the roller principle of load transmission whereby the track is made continuous, for shear and bending, without destroying free movement of the ends of the rails with variations in temperature, thereby eliminating "low joints" and "high centers," particularly eliminating "joint hammer," or the noise heard when wheels are crossing joints, reducing cost of track and rolling stock maintenance, producing an easier riding track, and avoiding the possibility of nuts working loose.

Pertaining to Vehicles

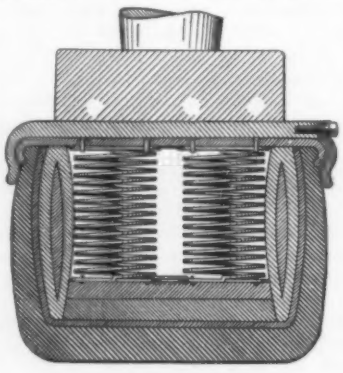
POWER TRANSMISSION.—J. S. WALLACE, Burlington, N. D. The invention pertains more particularly to a mechanism whereby power can be derived from an ordinary automobile for various purposes, as threshing grain, sawing wood, hoisting, pumping, generating electric current, and the like especially on farms. The



POWER TRANSMISSION.

invention improves and simplifies the construction and operation of machines of the character referred to so as to be reliable and efficient in use, and so designed that an automobile can be easily and quickly brought into operative relation with the apparatus.

RESILIENT TIRE.—S. SUSS, 117 E. 89th St., and A. Kaufman, 1596 2nd Ave., New York, N. Y. Among the objects of the invention is to provide a tire to take the place of the usual troublesome tire so commonly used on automobiles, motor cycles and other vehicles.



RESILIENT TIRE

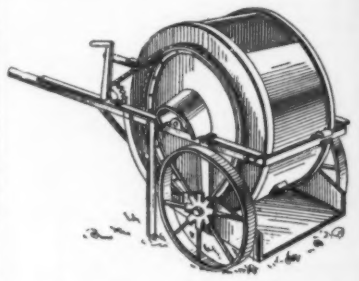
An object is to provide a tire of a unitary and complete construction adapted to be applied to or removed bodily from a wheeled rim of any standard or suitable nature, the new tire being provided with radially disposed coil springs of peculiar construction and connected to one another and to a rim portion of the tire by novel means.

RESILIENT WHEEL.—P. PIERI, Buckingham Hotel, 5th Ave., New York, N. Y. The invention has particular reference to the construction of wheels intended especially for automobiles or other vehicles for the conveyance of passengers or other loads. An object is to construct a vehicle wheel of peculiar form and possessed of special resiliency or ease of action under various loads or inequalities of roadway.

TIRE PUMP.—H. F. MOLKENBUR, 337 Forest St., St. Paul, Minn. This invention refers to air pumps, and provides a pump adapted for connection with pneumatic vehicle tires which will automatically maintain the air within the tire at a desired pressure by taking advantage of the variations from mean pressure while a vehicle is being driven over the usual road inequalities.

SLACK ADJUSTER FOR BRAKES.—A. WOODS, Box 221, Vernon, B. C., Canada. In this invention the brake rod and the slack adjusting means have a non-turning, reciprocating movement in one direction in response to a movement of the brake-applying means, and upon an abnormal return stroke due to slack, the slack adjusting means will be given a turning movement during a portion of said return stroke whereby to vary the total effective length of the brake rod to regulate the slack.

COMBINED DUMP CART AND MIXER.—L. L. CARTER, 186 22nd St., Portland, Ore. Mr. Carter's invention is an improvement in concrete mixtures, and the invention has for its object the provision of a portable mixer of the character specified, wherein a cylindrical

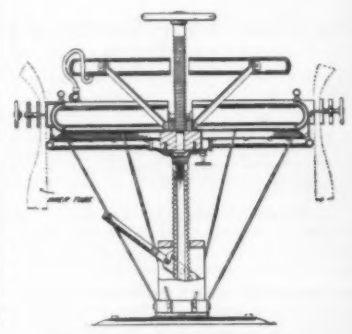


COMBINED DUMP CART AND MIXER

container is provided, having mixing vanes or blades, and mounted to rotate on a wheeled support, and having means for rotating the same, the support having a delivery chute to which the container delivers.

AUTOMOBILE WHEEL.—F. M. CROSS, Hundred, W. Va. The invention relates to an improvement in automobile or other vehicle wheels, and more particularly to that type in which the resiliency is imparted to the wheel at the hub or center thereof. It provides a wheel having a stationary hub around which the wheel rim travels, the hub being provided with means for imparting resiliency to the wheel.

VULCANIZER.—J. B. STROUD, Pass Christian, Miss. The invention provides a vulcanizer especially for use with automobile tires, wherein the vulcanizer is so arranged



VULCANIZER FOR AUTOMOBILE TIRES.

that the shoe or casing of the complete tire may be easily inserted for vulcanizing and removed, and wherein a number of inner tubes may be simultaneously vulcanized during the vulcanization of the tire. It so supports a portion of the vulcanizer that it may be adjusted at a convenient height for working on the tire and to permit the vulcanizer to be adjusted for various sizes of tires.

Designs

DESIGN FOR A FOLDER FOR GLASS PERCOLATORS.—R. KOHN, 43 E. 19th St., New York, N. Y. In this invention the design shows a post seated on a base. At the bottom of the former a thin arm holds a lamp and at the top of the post a heavy arm extends in one end of which is a ring shaped holder of the glass percolator. The design is exceedingly simple and graceful.

DESIGN FOR A RUBBER PAD FOR BOOTS AND SHOES.—H. P. FOUQUÉ, 218 Flushing Ave., Brooklyn, N. Y., N. Y. In this case the ornamental design for a rubber pad for boots and shoes, is shown in a side elevation and in an inverted plan view thereof.

DESIGN FOR A GAS HEATER.—G. F. REZNOR, care of Reznor Mfg. Co., Mercer, Pa. The design is characterized by a body having a transversely rounded top and a vertically rounding member ranging longitudinally across the front of the body at the bottom of the said top, said member projecting beyond the surface of the top, and the said body presenting a broad open front below the said longitudinally ranging member. Mr. Reznor has invented another design for a gas heater which is characterized by a front view presenting the simulation of a plurality of logs disposed on an incline, one above another, with rustic standards beneath the lowermost log, and rustic members ranging between the said standards.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

because of the lack of time to start the projectile in the gun.

Dynamite, lyddite, shimose, trinitrotoluene and kindred high explosives are made to detonate by suitable violent explosives in small volume, such as the fulminates or azides, while against this process is the slow, controlled, work-producing burning of the propellants used to drive the shot. It is under abnormal conditions, such as excessive pressures, that propellants cease to be propellants and turn high explosive. This is probably what happens when dense shotgun powder is loaded in double loads into a shotgun, because very often such error will blow out the chamber walls at the thickest point and not move the charge of shot clear out of the barrel.

Automatic pistols and revolvers have in the past been the children of trouble because of the use by cartridge makers of a finely cut leaf explosive, coming in little square leaflets as thin as tissue paper and having a great fondness for each other and for anything to which they may cling. So powerful is this powder that it occupies but a very small part of the space in the revolver or pistol cartridge. Three grains will drive the standard .32-caliber revolver bullet at more than the standard velocity. Because of the "stickness" of this powder, it has the pleasant habit of occasionally failing to fall through the measure when being loaded into shells, and leaving one cartridge with no powder or only part of a charge, while the next one profits (?) by the loss of the first one. The first one often drives the bullet only into the barrel, where the next shot will bulge the barrel of the automatic pistol, which is very thin, setting it up into the slide or casing and effectually putting the gun out of business.

Recent Improvements in the Transmission of Steam Through Underground Conduits

(*Concluded from page 558*)

duit to give clearance for pipe lines coupled with flanges instead of couplings. In each rib is a pair of pockets some 8 inches apart, one pair registering with the other, to receive the fingers of the pipe support and thus lock them into the predetermined positions, thereby preventing the support from creeping out of place through chattering or other disturbance of the pipe in or out of service. Creeping of the supports would alter the distribution of weight upon them and result, not unlikely, in the settling of the conduit, which would throw the pipe lines out of vertical alignment, the latter being an essential in realizing perfect drainage of the entrained water, preventing the accumulation of water in "dips," etc. The space between the ribs and below the supports forms a drainage passage permitting leakage or seepage to be carried away to the drain outlet without effecting the efficiency of the heating pipes.

The supports are perhaps the more interesting feature of the heat-conveying conduit. In the single pipe-line support the weight is distributed to the conduit through four points. The plural line supports, on the other hand, are anchored by bosses extending down into the rib-pockets and are supported by the cradle-plate bearing on the ribs the full length of the support at each side. The cradle portion of these supports—that which rests on the ribs or in the rib-pockets—has a depressed pocket with toothed racks and drainage holes. In this pocket is placed a toothed roller upon which rests the pipe-supporting saddle, having, on its under side, racks of teeth that mesh with the teeth on the roller. "Keeper" flanges on the saddle extend down over the ends of the roller to prevent side deflection of the pipe line in either direction. In operation, the roller travels one tooth over the cradle racks and carries the saddle one tooth forward on the upper teeth. The saddle travel is, by this action, twice as fast as that of the roller on the rack in the cradle-pocket, and a roller clearance of 3½ inches in the cradle-pocket therefore carries the saddle and the pipe resting upon it 7 inches—enough travel to take care of all the expansion ordinarily necessary in practical work. Extraordinary expansion travel demands the simple expedient of dividing the expansion element into two ranges. The teeth of the three elements of the support being in mesh, it is impossible for the roller to creep forward or backward through chattering of the pipe, or to skew forward or backward at either end. This insures the roller setting keeping its place permanently.

It is claimed by the manufacturer that a pipe installed as outlined herein can never sag out of alignment; that the pipe can be covered entirely at the supports, thus reducing the thermal loss to the utmost degree, and that the pipe is held high and dry so that seepage cannot affect the efficiency of the pipe in the slightest, nor the leakage permanently soak the insulating covering and so by its vapor destroy the efficiency of the heating line by condensing the steam within. The pipe and covering being high and dry and a drainage space being provided below it, underground drainage, usually so essential to any other forms of conduit, is not necessary with this in any but swampy or very wet ground, and generally then only as an extra precaution.

How an Inventor Successfully Conducted an Infringement Suit

(*Concluded from page 558*)

necessary to give the bench a comprehensive and a convincing grasp of the subject matter. Mr. Perlman, realizing that the judges were not engineers, asked himself how he could be made to understand the mechanical features if he were one of the court. The defense had cited no fewer than 150 patents and other alleged anticipatory disclosures; and their intention was to present and to discuss each of these in order to disprove infringement and, incidentally, to invalidate the claims embodied in the Perlman patent. Realizing that the court might be confused by the mass of evidence, the inventor and his attorneys cleverly prepared, after much study, two striking exhibits.

One of these showed graphically on an enlarged scale the eleven fundamental classes of rims covering the prior art, and then by nine other drawings on a like scale they illustrated the evolution of the art of demountable rims so far as was akin to the patent involved. Another bone of contention was the action of the wedges covered by the Perlman patent. It had been disputed that the adjustment of these sufficed to exert pressure in more than one direction. The inventor claimed that in seating these threaded wedges or taper-tip bolts he was able to accomplish a wedging effect radially and sidewise, thus tightening the rim circumferentially on the wheel while securing it so that it would not slide off. To demonstrate this dual action, the plaintiff devised a mechanism that showed upon two graduated scales, set at right angles, that force exerted by an inclined plane, acting upon a point in space, to produce a desired pressure on one scale automatically attained the same measure of pressure upon the other scale. The veriest layman was able to see the drift of that mechanically established argument.

Ordinarily, the plaintiff in an infringement suit merely describes the features claimed by the patent involved and explains their application or force. Then the defense proceeds to cite the prior art and to parade its array of supposedly anticipatory patents. In the Perlman suit there was a big battery of these, designed to hammer away at the plaintiff's case; but that formidable aggregation was largely spiked at the start by the course pursued in the opening address of plaintiff's counsel. The court was quickly familiarized with the prior art by reference to the first eleven diagrams; and the nine other drawings alone covered the essence of the matter in suit. When the defense took up the case, the court promptly classed each patent as it was cited under one or the other of the eleven heads, and, as a result, only twelve out of the total number of patents were really the subject of argument. In short, the

plaintiff's counsel educated the court at the very start, and thus prevented confusion and saved time.

There are probably 3,000,000 automobiles in service to-day in this country; and it is estimated that the factories will turn out 1,200,000 cars for the season here of 1917. Approximately, 60 per cent of existing cars and 80 per cent of those building for the American trade are designed to carry demountable rims. A set consists of five tire rims, four felly bands, and associate parts; and the present market value per set is in the neighborhood of $15. This contribution to motoring comfort will, therefore, represent an annual business to the rim makers of anywhere from $20,000,000 to $25,000,000, allowing for repairs and replacements. No wonder the inventor has fought for his patent and defended his title since it issued a little over three years ago.

A Machine That Picks Cotton Without Injuring the Plant

(*Concluded from page* 551)

of the machine and returned to the center passageway, ready to pluck the cotton bolls from a fresh plant. The design of the picker points makes it impossible for them to be twisted together, hence the most vulnerable member of most cotton-picking machines is in this case perhaps the strongest.

The cotton-picking machine described has been developed and perfected during the past few years. Aside from the features already mentioned, it claims light weight—about 1,000 pounds.

War Game—XI

(*Concluded from page* 557)

The stricken transport reached shallow water just in time to be saved from sinking. The troops immediately began to land on Thompson's Island.

The Blue torpedo boats, firing at the landing Red troops, retired toward the river. The "Sphinx" was put out of action by a shell from the Red cruiser, and limped into Hatfield harbor.

At 5 P.M., under cover of a heavy fire from all the enemy war craft, the two transports steamed into the bay and dropped anchor behind Murphy Point breakwater and immediately began to land, with the help of boats and lighters.

At 6 P.M. two battalions of infantry, with machine guns, were established across the small peninsula.

Questions

Question 1. The action of the Blue detachment under General G was purposely left out of the above. Supposing that General G was, at 2:40 P.M. at the Sherwood Field Club Building, observing the naval situation, what disposition would he make?

Question 2. There is another Blue coast battery hidden somewhere around the bay. Why did this battery of 3-inch rapid fire guns remain silent?

Question 3. Assume that the position of this Blue coast battery is behind the small hill south of the railway bridge; when the transports put in to land troops what will the commander do, and will he open fire? Consider the Red battle cruiser, with its 12-inch guns, is at 3,500 yards range.

Question 4. Locate the position of the Blue forces at 5 P.M.

Question 5. At what hour will the field batteries of the Blue forces open fire, and what will be their target?

Question 6. At 6:10 an explosion, caused by a torpedo sent from the Blue submarine, sinks the battle cruiser of the Reds. What will happen?

Answers to Questions in War Game X

Question 1. When Captain B, with his company in the firing line, has approached to within 200 yards of the cemetery, which is defended by a platoon of Red infantry, he has decided to make the assault. First of all, he looks to see if all of his men have their bayonets fixed. He will then signal to his supports, upon whose aid he counts to carry through the assault. These men come forward on the run. As they arrive the signal for "cease firing" is given. Then, leading his men, Captain B orders: "Follow me," and the enemy position is rushed.

Question 2. The enemy, driven from his position in the cemetery, can best be pursued by fire. Therefore a command to this effect will be given.

Question 3. Seeing the heavy reserves moving to assault the trenches, General G realizes that the enemy will attempt to pierce his lines near the small woods south of the railway bridge. He immediately decides to open fire with his three guns, which have not yet been utilized by the Reds nor discovered by the Blues. Since the artillery observing station is also in the tower with him, he will simply give his order to the artillery officer. The latter will immediately send word by telephone to the commander of the guns, giving him the target, the range and the deflection.

Question 4. Considering that the Blue forces intend to penetrate the Red line near the small woods south of the railway bridge, the best place for the machine guns would be either to the right or to the left of the point where the assault is expected to be made. By a flanking fire the defenders of the trenches to be assaulted can be held down to the last moment.

Question 5. "Goat Hill,
"14 June, 19—, 9:00 P.M.
"We will hold the present position.
"Entrenchments will be constructed and position prepared along the Norristville-Pottstown Railway.
"The commanding officer of the left flank company will send a squad of volunteers to blow up the dam built by the enemy at the bridge over Conestoga Creek.
"Cavalry remains as detachment reserve at the edge of Paoly Forest.
"I will be with the reserve."

War Game XII will deal with the strategical planning of a campaign and the working out of its tactical details.

A Significant Automobile Record

(*Concluded from page* 552)

by the way, was made last year by the same driver, E. G. Baker, was 11 days, 7 hours, 15 minutes; and the best record claimed to have been made by a relay team of four or five drivers is 10 days, 15 hours.

The route from Los Angeles was through Flagstaff, Ariz.; Albuquerque, N. M.; Trinidad, Colo.; Dodge City and Emporia, Kan.; Kansas City, Mo.; St. Louis, and thence to Indianapolis, Ind., through Columbus, Ohio, and via Wheeling to Pittsburgh, and then to Philadelphia, and through Trenton to Jersey City.

The car used in this test was a regular standard model, fully equipped with top, wind screen and guards, and all the other fittings that are found on the car as it is delivered to the ordinary buyer. The crew consisted of but two men, E. G. Baker, the driver, who held the wheel the entire distance, and W. F. Sturm, a newspaper man, who is in no sense a mechanician; but the lack of expert technical assistance was no handicap, for it is asserted that not even a spark plug was changed on the journey, and the only adjustment made was of the carbureter while in the mountains of Arizona to compensate for the excessive elevation. The only repair considered necessary was the replacement of a front axle which had been slightly bent by colliding with the parapet of a bridge, but this was only as a matter of precaution, as several hundred miles were covered with the bent axle before the change was made.

Good weather was experienced most of the way, but through Missouri heavy mud was the rule, and in one case two hours were required to cover ten miles. In this region the engine was run continuously on intermediate gear for 84 miles, an excellent test for endurance and radiator efficiency.

As already stated, the average speed was about 450 miles a day. The best day's run was 587 miles, and the highest speed recorded was 68 miles an hour.

These figures indicate a remarkably regular and well sustained speed, rather than a series of excessively fast dashes where the going was easy. The consumption of gasoline figures at about 9¼ miles per gallon, and the oil at about 350 miles to the gallon, which is excellent, considering that the car was driven to the limit every foot of the way, with no regard for economy.

It is not intended to suggest that a four- or a six-cylinder car is not capable of a similar performance, but only to point out that this test effectually disposes of any doubts that may have existed as to the dependability of the multi-cylinder engines. From every point of view the demonstration made on this occasion records a triumph of engineering, and shows the perfection that can be attained by scientific designing, the selection of materials and accurate manufacturing processes. As a feat of human endurance the journey is unparalleled.

Death of Elmer L. Corthell

AFTER an illness of several years' duration, Dr. Elmer L. Corthell of North Egremont, Mass., died at a local hospital on the afternoon of May 16th, having attained the age of 77 years. Dr. Corthell was president of the American Society of Civil Engineers, and one of the most noted civil engineers in this country. He had been prominently identified with numerous engineering societies both here and abroad.

The Civil War broke out while Dr. Corthell was studying at Brown University, whereupon he enlisted in the First Regiment, Rhode Island Light Artillery, and saw four years' service in the Virginia and North Carolina campaigns. At the end of the war he resumed his studies at Brown University, graduating with the degree of A. B. in 1867. One year later he received his A. M.

He then took up engineering work and served in the construction of several Middle West railroads. In 1875 Dr. Corthell took charge of important engineering work at the mouth of the Mississippi River. Four years later he left for the Isthmus of Tehauntepec, Mexico, where he conducted surveys on both the Atlantic and Pacific Coasts for the proposed ship railway. Shortly after he built the New York, West Shore & Buffalo and the New York, Ontario & Western Railways into New York. During 1885-87 he spent all his time working on the ship railway project, following which he entered into partnership with George S. Morrison and supervised many large harbor works, bridges and viaducts. Some time later he undertook the construction of the jetties of the Mexican Central Railroad at the mouth of the Panuco River in Tampico; and then, in 1891, went abroad to make a number of important investigations. He spent much of his time gathering data for the establishment of the School of Engineering and Architecture at his university.

During a period of eleven years he was engineer of the Boston, Cape Cod and New York Ship Canal which cuts across the Isthmus of Cape Cod. In 1899 and for several years thereafter he served the Government of Argentine Republic in various engineering and representative capacities.

Recent Paper Statistics

IN our issue of May 6th we published an article on the Paper Situation by Mr. William Bond Wheelwright. While the issue was on the press the Bureau of the Census issued a preliminary statement of the general results of the 1914 census of manufacturers for the production of paper and wood pulp. The following statistics will be of interest as supplementing the article by Mr. Wheelwright:

In 1909 the production of wood pulp was 2,498,955 tons. In 1914 this had increased to 2,894,650 tons. This represents an increase of 15.8 per cent. In addition to the domestic production, 534,395 tons of pulp was imported, an increase of 77.3 per cent over 1909. Other materials used during 1914 comprised 371,346 tons of rags, 1,577,845 tons of waste paper, 121,-

LEGAL NOTES

Expensive Refunds.—Under the present system, which Commissioner Ewing seeks to have corrected, all refunds of money paid the Patent Office by mistake must be certified to the Treasury Department. These are audited and thereafter Treasury warrants for the respective sums drawn. Out of 6,000 a year, three fourths of the warrants are for less than one dollar and hundreds of them are for five cents each. The auditing and refunding are estimated to cost one dollar for each transaction, so that in hundreds of instances one dollar is the cost of refunding five cents.

An Important Recommendation.—Commissioner Ewing has suggested to Congress that the law be amended to require the clerks of the Federal courts to file in this office a copy of every decree granting or refusing an injunction in a suit for infringement of a patent and every final decree affecting the validity of a patent.

If such copies were filed in the Patent Office and placed in the file of the patent, it would enable any one to determine the litigation in which this patent had been involved, a thing which is now practically impossible since many of the decisions of the lower courts are not published.

Disregards Priority of Adoption of Trademark Under Circumstances.—The Supreme Court of the United States on writ of certiorari in cases involving certain flour-milling companies held that: Where two parties independently are employing the same mark upon goods of the same class, but in separate markets wholly remote from one another, the question of priority of adoption of the mark is legally insignificant unless at least it appears that the second to adopt the mark has done so with some design inimical to the interests of the first user.

The Farmer and the Mechanic.—In addressing an agricultural fair, Bob Ingersoll told of the farmers' dependence on the mechanic and the inventor, saying:

"Many farmers seem to imagine that farmers are the only laborers in the world. This is a mistake. You can not get along without the mechanic. You are not independent of the man of genius. Your prosperity depends upon the inventor. The world advances by the assistance of all laborers, and all labor is under obligations to the inventions of genius. The inventor does as much for agriculture as he who tills the soil. Until genius and labor formed a partnership there was no such thing as prosperity among men. Every reaper and mower, every agricultural implement, has elevated the work of the farmer, and his vocation grows grander with every invention. In the olden time the agriculturist was ignorant; he knew nothing of machinery; he was the slave of superstition."

National Defense and International Peace

What the Engineers are Doing

THIRTY thousand American engineers are making a card index survey of American industry so that it may be prepared for its vital part in defending the Country, if need comes. The past eighteen months have taught us here in America what lack of industrial preparedness has meant to some of the countries now at war. These nations had the ships and they had the men; but when the hour struck, their factories were not able to furnish the colors with arms and shells and powder. Their factories were not prepared. And our factories are not prepared.

But it is not enough to draw a moral. In the United States five great Engineering Societies — Civil, Mining, Mechanical, Electrical and Chemical — have pledged their services to the Government of the United States, and are already working hand in hand with the Government to prepare industry for the national defense. They receive no pay and will accept no pay. All they seek is opportunity to serve their country, that she may have her industries mobilized and prepared as the basic line of defense

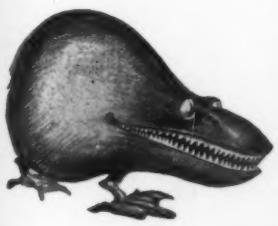
All elements of the nation's life — the manufacturers, the business men, and the workingmen — should support this patriotic and democratic work of the engineers, and assist them cheerfully when asked. *There can be no better national insurance against war.*

The Associated Advertising Clubs of the World, representing all advertising interests have offered their free and hearty service to the President of the United States, in close co-operation with these five Engineering Societies, to the end that the Country may know what the engineers are doing. The President has accepted the offer. The engineers have welcomed the co-operation.

This advertisement, published without cost to the United States, is the first in a nation-wide series to call the country to the duty of co-operating promptly and fully with the Engineers to prepare industry for

NATIONAL DEFENSE AND INTERNATIONAL PEACE

Did you ever meet an Alligator Pear?



The alligator pear is not vicious—won't even bite (though frequently bitten) and does not look like the picture at all. The alligator pear is another of those subtropical delicacies which some western farmers are fond of growing to tickle the palates of discriminating people. Folks who like them gladly pay as much as fifty cents the pear—some profit for the grower!

You ought to know more about the West—

We believe the Pacific Slope quite the most interesting section of the United States—and that is why *Sunset Magazine* is published. We *have* to keep posted on the West because we make it our business to give *free*, accurate, reliable information about the whole Pacific Slope Country, its lands and resources, what to see, how to see it, where to stop, the automobile highways, etc., a service that we are quite proud of, because we've helped thousands to know the West better. Perhaps we can help you. The coupon is easily clipped. Send it along now!

"I-WANT-FREE-INFORMATION" COUPON—CLIP IT TODAY!

Sunset Magazine, San Francisco, California

I am interested in the Pacific Slope Country and would somewhat appreciate information about: (Check)

☐ California ☐ Montana ☐ Idaho ☐ Farm Lands ☐ Arizona ☐ Auto highways
☐ Nevada ☐ Hotels and Resorts ☐ Washington ☐ Oregon
☐ Mexico ☐ For sample copy of Sunset Magazine ☐ Investments ☐ Irrigation

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Sunset Magazine

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Industrial Number

SCIENTIFIC AMERICAN

June 3, 1916

FIVE months ago, the SCIENTIFIC AMERICAN launched a campaign of Industrial Preparedness for Peace, the object being to preach the gospel of National Efficiency, to arouse the American people to the wonderful opportunities for industrial development at the present time, and to warn them against the commercial war that will follow the declaration of peace in Europe. The intervening period has been one of great prosperity and there is danger that we may be lulled into a sense of security by the absence of competition and may be so busy storing up wealth, as to forget to prepare for the struggle that is sure to come when the warring nations lay down their arms. It is for this reason that we are preparing a special *Industrial Number*, to be issued the first Saturday in June. This number will be filled with interesting material supplied by writers who are specialists in their several lines. The following are a few of the subjects that will be dealt with:

Germany's Strategic Hold on American Industries

This article will show that the vast majority of the needs of this country are or can be produced here; however, our industries have been throttled by German control of certain essential products. Not until we can overcome this control may we become industrially independent.

Developing Trained Foremen

Dr. Allen Rogers of Pratt Institute will tell what his institute is doing toward the educating of young men for industrial positions. We need coöperation between manufacturers and our schools and universities to bring our industries up to the high plane they should occupy.

Our Agricultural Unpreparedness

Mr. Grosvenor Dawe shows that the tendency of our farmers to leave the country and come into the cities is a material factor in the increase of cost of living and makes for greater poverty in cities. This matter is of vital importance in our National Preparedness for Peace.

Burning Kerosene in the Gasoline Engine

Undoubtedly the war has had much to do with the increased cost of gasoline. We are coming to the point where some substitute fuel must be developed. There are many carburetors designed to use kerosene after the engine has once been started by gasoline. A valuable article on this subject, describing the principal types of kerosene carburetors and their particular advantages has been prepared by Victor W. Page, the Motor Truck Editor of the SCIENTIFIC AMERICAN.

A Census of Industrial Facilities for War

Wars of to-day depend as much upon the man in the machine shop as the man in the trench. Such being the case it behooves us to take stock of our industrial facilities in order that we may be prepared, in case of a conflict with a foreign power, to marshall the vast industrial forces of this country for its protection. An article telling of the work that is being done by the Naval Consulting Board in investigating and tabulating American industries will be published in our Industrial Number.

Standardization As a Means of Preparedness

In time of war it is important to have standard machine parts in order that they may be readily replaced in case of injury. With this in view efforts are being made to standardize automobile parts in this country.

In addition to the articles above listed there will be many others dealing with special phases of Industrial Preparedness for Peace and for War.

A colored cover by Gerrit A. Beneker

15c at all newsstands

MUNN & COMPANY, Inc., Publishers

WOOLWORTH BUILDING **NEW YORK CITY**

Service-Safety-Appearance

THE expert who builds a bridge and the specialist who builds a tire are alike in this—they cancel distance and they greatly increase the comforts of travel.

They are alike, too, in this—that when service has reached the possible limit of excellence the builder turns his attention to outward ornament.

This double refinement in building is shown in the color combination of this Firestone Tire with its impressive trade-mark—

Red Side Wall and Black Tread

This versatile efficiency is also applied in specialized Factory methods which, with unapproached distribution, give you the "good measure" of Firestone service at an average cost.

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"America's Largest Exclusive Tire and Rim Makers"

Firestone

NON-SKID TIRES

INDUSTRIAL NUMBER

SCIENTIFIC AMERICAN

June 3, 1916

Munn & Co., Inc., Publishers
New York, N. Y.

Price 15 Cents

ROLL CALL OF
WHITE TRUCKS

In the Service of Big Fleet Owners Year After Year

NOTE who these truck owners are and then observe how their fleets of White Trucks *grow* year after year. There is no truck roll call in America like it. It includes owners who stand for the highest efficiency in business and who purchase their trucks, as they purchase every other operating unit, on the basis of actual performance expressed in terms of low eventual cost.

Fleet owners and the number of White Trucks in their service each year. The last column includes only the first four months of 1916.

OWNER	1910	1911	1912	1913	1914	1915	To-day
B. Altman & Company	0	0	8	8	33	67	79
American Express Company	0	0	0	7	8	8	13
Ammen Transportation Company	0	0	2	7	8	9	11
Anheuser-Busch Brewing Association	0	0	0	0	0	1	15
Armour & Company	0	4	30	51	63	84	107
Associated Bell Telephone Companies	0	1	6	30	46	84	135
City of Atlanta	0	3	6	8	10	10	11
Atlantic Ice & Coal Corporation	0	0	0	15	15	15	20
Atlantic Refining Company	1	4	9	31	67	86	92
The Bailey Company	0	1	3	6	6	13	15
City of Baltimore	0	3	4	7	14	14	15
The Bell Company	0	1	2	6	11	12	12
Bellevue & Allied Hospitals	0	0	0	1	3	9	12
Robert W. Blake	0	0	0	1	6	6	10
Boggs & Buhl, Inc.	0	8	10	18	23	25	25
Henry Bosch Company	2	8	8	9	10	10	11
City of Boston	0	2	9	12	17	18	19
Bradford Baking Company	0	0	0	9	20	25	25
City of Chicago	0	0	0	1	4	10	10
Brooklyn Alcatraz Asphalt Company	0	0	0	2	9	9	11
Chicago Fire Insurance Board	0	0	5	11	13	13	13
City of Cleveland	0	2	7	14	15	19	19
Cleveland-Akron Bag Company	6	7	9	14	15	19	19
Cleveland Builders Supply Company	0	1	1	3	4	7	10
Cleveland Electric Illuminating Co.	0	0	0	0	0	6	16
Coca Cola Bottling Companies	0	3	6	12	26	38	47
Consolidated Gas, El. Light & Power Co.	2	3	6	8	11	12	12
Cudahy Packing Company	0	0	2	6	8	10	11
T. Eaton Company, Ltd.	0	5	13	14	15	15	18
Foster & Kleiser, Inc.	0	2	4	4	8	10	10
Georgia Railway & Power Company	0	0	1	3	7	7	10
Gimbel Brothers	0	20	26	46	59	59	59
Glacier Park Transportation Company	0	0	0	0	10	20	20
B. F. Goodrich Company	4	6	9	11	12	17	19
Great Northern Paper Company	0	0	0	1	1	11	12
Greenfield Electric Light & Power Co.	0	3	6	9	10	11	13
Gulf Refining Company	0	1	9	29	81	172	203
The Higbee Company	2	4	5	6	10	10	10
Joseph Horne Company	5	12	15	24	33	39	42
J. L. Hudson Company	0	0	0	0	0	10	10
Independent Brewing Co. of Pittsburgh	1	1	2	5	5	11	19
Jones Store Company	0	2	2	5	6	10	11
Kaufmann Brothers	0	0	10	16	24	44	44
Kaufmann & Baer Company	0	0	0	1	40	45	48
Theodor Kundtz Company	3	7	8	9	10	11	12
Leyte Land Transportation Company	0	0	3	6	10	12	12
Los Angeles Brewing Company	0	0	2	7	13	14	15
McCreery & Company	6	6	8	8	8	11	12
G. M. McKelvey Company	0	0	1	1	6	8	15
Mandel Brothers	0	9	10	15	16	17	17
The May Company	0	0	0	4	11	15	24
Michelin Tire Company	0	1	2	3	3	9	11
National Casket Company	0	0	2	10	14	15	16
City of New York	0	1	7	11	12	13	13
New York Board of Fire Underwriters	0	0	2	6	8	16	18
Oppenheim, Collins & Company	0	0	0	0	20	21	25
Pacific Mills	0	0	3	4	4	7	11
Frank Parmelee Company	0	0	0	9	9	18	18
C. C. Parsons Company	0	2	3	6	8	12	14
Pike's Peak Auto Company	0	0	0	0	0	12	13
City of Pittsburgh	0	2	9	14	14	15	15
Public Service Corporation of N. J.	0	0	0	0	0	4	11
The Rosenbaum Company	1	1	2	11	12	33	34
Saks & Company	0	0	0	0	10	10	10
Schulze Baking Company	1	1	9	15	17	22	22
Franklin Simon & Company	0	0	0	3	6	10	10
W. & J. Sloane	13	14	15	15	15	17	19
Southern Express Company	0	0	0	2	9	11	17
Spear & Company	0	0	1	9	13	14	16
Standard Oil Company of California	1	3	4	6	7	26	31
Standard Oil Company of Indiana	1	4	5	9	59	122	135
Standard Oil Company of Kentucky	0	1	2	4	5	9	10
Standard Oil Company of Nebraska	0	0	0	0	5	11	13
Standard Oil Company of New York	2	6	18	35	68	113	134
Standard Oil Company of Ohio	0	1	1	1	10	17	19
Stern Brothers	0	0	8	18	18	19	19
Stroehmann Baking Company	0	0	0	2	2	2	10
Swift & Company	0	0	0	2	2	10	29
Telling-Belle Vernon Company	0	3	4	4	9	11	11
The Texas Company	0	0	0	0	0	9	11
Union Oil Company of California	0	0	0	1	10	22	25
United States Post Office Department	0	0	0	21	27	104	111
John Wanamaker	0	0	0	0	0	6	27
Ward Baking Company	0	0	0	0	0	12	44
Raphael Weill & Company	0	0	0	0	0	10	10
White Transit Company	0	1	1	2	6	9	11
	51	170	369	750	1270	1997	2404

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